The Bradford White

Ultra High Efficiency Water Heaters

SERVICE MANUAL

Troubleshooting Guide and Instructions for Service

(To be performed ONLY by qualified service providers)

For The Bradford White eF Series® Ultra High Effeciency Models:

EF60T125E*(NA,XA)(2)
EF60T150E*(NA,XA)(2)
EF60T199E*(NA,XA)(2)

EF100T150E*(NA,XA)(2)
EF100T199E*(NA,XA)(2)
EF100T250E*(NA,XA)(2)
EF100T300E*(NA,XA)(2)
EF100T399E*(NA,XA)(2)

(*) Denotes Warranty Years

Manual 45817B

Save this manual for future reference

BRADFORD WHITE CORPORATION

The Bradford White

Ultra High Efficiency Water Heaters

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Introduction

The Bradford White eF Series® Ultra High Efficiency Water Heater is designed to deliver a remarkable thermal efficiency rating in a quiet running unit with venting options that allow for installation flexibility. Several technologically advanced design features are incorporated in the design that will require additional knowledge on the part of the qualified service provider. The information in this manual will instruct service and maintenance professionals on the function, proper diagnosis and repair of The Bradford White eF Series® Ultra High Efficiency Water Heater.

The Bradford White eF Series® Ultra High Efficiency Water Heater uses a low Nox premix power burner located at the top of the water heater to direct a turbulent flame down into a submerged combustion chamber. This turbulence causes a thorough mixing of gas and air for optimum combustion. The combustion gases then travel through a three pass flue system keeping the gases moving at a high velocity. The combination of high turbulence and velocity results in an optimum transfer of heat from the flue gases into the water.

Burner operation is controlled using an electronic ignition module. The module monitors the status of the electronic thermostat, vent temperature limit switch, vent system pressure switches and a flame sensor to control output voltage to blower motor, hot surface igniter and gas valve. The module contains programming which determines the sequence of operation and timings for purge periods, trial for ignition, flame sensing and lockout. The module will also provide diagnostic information on LEDs to help in determining the cause of system lockouts.

The contents in this manual are detailed informational tools to assist in the proper diagnosis of the eF Series® Ultra High Efficiency Water Heater operational faults. Please read this service manual completely and provide as much information regarding the eF Series® Ultra High Efficiency Water Heater operation and installation specific concerns.

How to Use This Manual

It is intended for this manual to be used by qualified service personal for the primary purpose of troubleshooting analysis and repair of the Bradford White eF Series® Ultra High Efficiency Water Heater. Understanding the sequence of operation section of this manual will contribute greatly to troubleshooting this product.

An “Installation Check List” is shown on page 50. Compare the installation against the installation check list to confirm all requirements are met.

An “eF Service Report” is shown on page 51. Completing this form will assist in the troubleshooting efforts. Should you need to call for technical support, Please provide the information shown on this form to the support technician to insure accurate troubleshooting.

Troubleshooting begins with “System Observation” to determine failure mode as indicated by the LED status of the ignition module. Troubleshooting continues with “Failure Modes and Probable cause” listed on page 11 directing the service provider to a series of test procedures to determine root cause of failure. Component replacement procedures directly follow the test procedures for a given component.

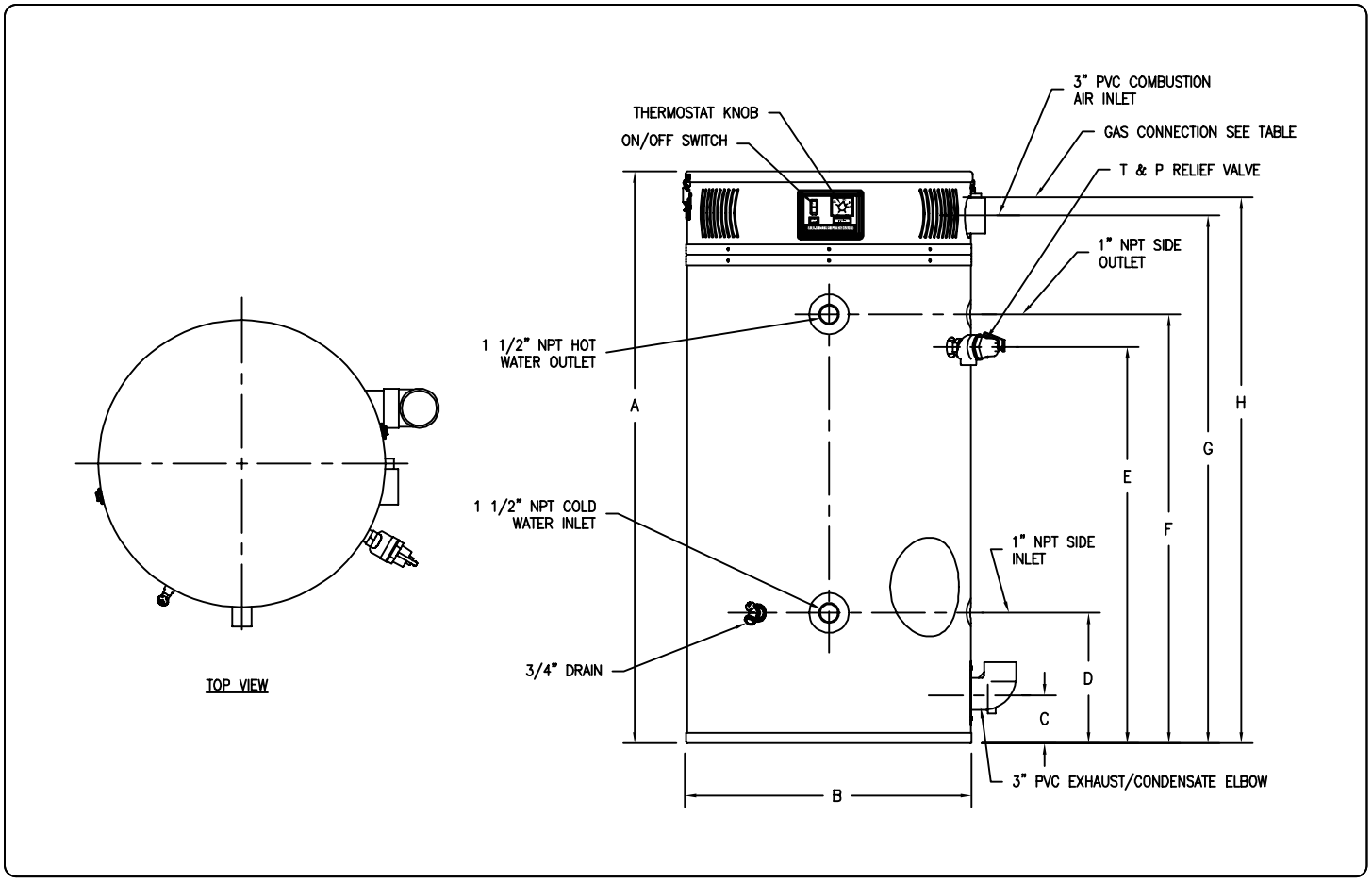
In some difficult to diagnose conditions, it may be necessary to isolate the heater from the vent system to determine root cause.

Contact Technical support immediately if diagnosis is not determined using the methods described in this service manual.

Tools Required for Service

Manometer:	Two types available, a liquid “U” tube type or a digital (magna-helic) type. This device is used to measure gas and/or air pressures and vacuum.
Multi-Meter:	A digital type is strongly recommended. This device is used to measure electrical values. The meter you select must have the capability to measure volts AC, volts DC, Amps, micro-amps and ohms.
Thermometer:	Used to measure water temperature. An accurate thermometer is recommended.
Water Pressure Gage:	Used to measure water supply pressure. Also used to determine tank pressure by adapting to the drain valve of the heater.
Jumper Leads:	A length of wire (12" min.) with alligator clip at both ends.
Various Hand Tools:	Pipe wrench, channel locks, open end wrench set, 12" crescent wrench, Allen wrench set, torx bit set, screw drivers (common & phillips), long reach (12") magnetic tip phillips head screw driver #2 tip, ¼" nut driver, pliers (common & needle nose), socket set including a 1-1/16 deep well socket, wire cutters, wire strippers, wire crimpers, torpedo level, small shop vac, step ladder, and flashlight.

Specifications



			Recovery GPH at Degree Rise					DIMENSIONS (INCHES)												
Model No	Input Rate BTU/h	1st Hr Del Gal at 100°F Rise	40°F	100°F	140°F	Stg Cap U.S. Gal	Therm Eff %	A Ht	B Dia	C Flr to Vent Outlet	D Flr to Inlet Wtr Conn	E Flr to T&P Valve Conn	F Flr To Outlet Wtr Conn	G Flr. To Air Intake	H Flr to Gas Conn	Front Wtr Conn Dia	Space Heating Conn Dia	Gas Conn Dia	T&P Valve Open	Shpg Wt (lbs)
EF60T125	125,000	187	363.6	145.5	103.9	60	96.0	57	28 3/8	5	13	40	42 ¼	52 ½	53 ½	1 ½	1	¾	¾	570
EF60T150	150,000	211	422.7	169.1	120.8	60	93.0	57	28 3/8	5	13	40	42 ¼	52 ½	53 ½	1 ½	1	¾	¾	570
EF60T199	199,999	265	557.6	223	158	60	92.0	57	28 3/8	5	13	40	42 ¼	52 ½	53 ½	1 ½	1	¾	¾	570
EF100T150	150,000	250	450.5	180.2	129	100	99.1	77 5/8	28 3/8	5	13	60	62 ¼	73 1/8	74 ¾	1 ½	1	¾	¾	900
EF100T199	199,999	309	597	238.8	171	100	98.5	77 5/8	28 3/8	5	13	60	62 ¼	73 1/8	74 ¾	1 ½	1	¾	¾	900
EF100T250	250,000	364	734.8	293.9	210	100	97.0	77 5/8	28 3/8	5	13	60	62 ¼	73 1/8	74 ¾	1 ½	1	¾	¾	900
EF100T300	300,000	405	836.4	334.5	239	100	92.0	77 5/8	28 3/8	5	13	60	62 ¼	73 1/8	74 ¾	1 ½	1	¾	¾	900
EF100T399	399,999	521	1,127	451	322	100	93.0	77 5/8	28 3/8	5	13	60	62 ¼	73 1/8	73 ¼	1 ½	1	1	1	950

Specifications

Power supply	Dedicated 120 VAC, 60 Hz, 15A, GFI
Gas Supply	Minimum 1" NPT for EF100T399, all others ¾" NPT (schedule 40 black iron pipe recommended)
Approved Gas Type	Natural or Propane. Unit must match gas type supplied.
Gas Pressure (Nat & L.P.)	14.0" W.C. maximum static, 4.5" W.C. minimum running (recommend 7.0" W.C. min running)
Venting System	Power vent, balanced direct vent or unbalanced direct vent. See vent tables on page 7
Approved Vent Materials	PVC, CPVC or ABS
Minimum Clearance for Servicing	18" from top, 24" from front, 4" sides and rear.
Maximum Water Supply Pressure	150 PSI
Thermostat Sensor	11,900 Ohms @ 70°F, ECO opens @ 201°F Max., ECO close @ 100°F Min.
Temperature Dial	Min. set point 5400-6600 ohms, Max set point 0-50 ohms.
Thermostat Board	Max temp 180°F, Min temp 91°F, 24VAC, 60Hz max.
Ignition Module	See page 11.
Transformer	120VAC primary, 24VAC secondary, 40VA.
Hot Surface Igniter	120VAC, 30-120 ohms @ room temperature.
Flame Sensor Output	Minimum 1 micro amp, Typical range 4 to 7 micro amps.
Gas Valve	Negative regulation, 24 VAC, ½" PSI max., 4.5" W.C. Minimum running inlet.
Vent Safety Switch	Normally closed, opens @ 350°F, manual reset.
Intake Pressure Switch "CF" serial number or later	Not required.
Intake Pressure Switch serial numbers prior to "CF"	24VAC, normally closed, opens on vacuum increase @ -1.20 W.C.
Blocked Vent Pressure Switch "CF" serial number or later	24VAC, normally closed, opens when pressure increases to +2.70 W.C.
Exhaust pressure switch serial numbers prior to "CF"	24VAC, normally open, closes on pressure increase as follows Note 1: +2.58" W.C. EF(60,100)T199 +1.50" W.C. EF100T150 (see note 2) +1.22" W.C. EF60T150, EF100T250 +2.08" W.C. EF60T125 +0.55" W.C. EF100T300 (see note 3) Note 2: +5.6" W.C. on serials prior to AH5039107 Note 3: +0.8" W.C. on serials prior to AK5288269
Blower	120VAC, 60Hz, .6-1 amps, 6400 RPM.
Combustion Levels	CO2: 10-11%, CO: less then 0.04 percent (400 PPM) air free

Vent Tables

Balanced Direct Vent Systems PVC, CPVC or ABS		
Total length of intake piping and exhaust piping added together must not exceed "Maximum Combined Length" Shown below		
Maximum Combined Length (feet)		
Model Number	**3"**	**4"**
EF60T125, EF100T150	**120'**	**170'**
EF60T150, EF100T199	**100'**	**150'**
EF60T199, EF100T250	**80'**	**130'**
EF100T300	**60'**	**110'**
EF100T399	**50'**	**100'**
Unbalanced Direct Vent Systems Air intake CAN NOT exceed exhaust by more than 30 feet		

Power Vented Systems PVC, CPVC or ABS		
Total length of exhaust piping must not exceed "Maximum Vent Length" Shown below		
Maximum Vent Length (feet)		
Model Number	**3"**	**4"**
EF60T125, EF100T150	**120'**	**170'**
EF60T150, EF100T199	**100'**	**150'**
EF60T199, EF100T250	**80'**	**130'**
EF100T300	**60'**	**110'**
EF100T399	**50'**	**100'**

Notes:
1) Multiply the total number of 90° elbows (intake and exhaust) by 5 feet. Do not include the termination fittings or 3" condensate elbow.
2) Multiply the total number of 45° elbows (intake and exhaust) by 2 ½ feet.
3) Add this to the total length of straight pipe - intake and exhaust.
4) The sum total of all elbows and straight pipe - intake and exhaust must not exceed maximum lengths from tables above.

Example: EF100T199
A 3" Balanced Direct vent system has 30 feet of straight exhaust pipe and 30 feet of straight intake pipe. It has 3- 90° elbows in the exhaust and 3- 90° elbows in the intake. It has 1- 45° elbow in the exhaust and 1- 45° elbow in the intake.

Therefore:
6- 90° elbows x 5 feet = 30 feet.
2- 45° elbows x 2½ feet = 5 feet.
60 feet of straight pipe + 30 feet + 5 feet = 95 feet.
System is within "Maximum Combined Length" from table above.

Sequence of Operation

For models prior to CF serial numbers

For models prior to CF serial numbers

1. Thermostat calls for heat.
   -Prior to energizing blower, ignition module checks safety circuits for normal switch positions:
   a) Vent temp switch normally closed.
   b) Intake pressure switch normally closed.
   c) Exhaust pressure switch normally open.

   If the vent temp switch is open, the control waits **indefinitely** for temp switch to close (green light stays on).

   If the exhaust pressure switch contacts are closed (not in normal position), the ignition module will wait 45 seconds for pressure switch contact to open before energizing blower. If after 45 seconds and pressure switch contacts do not open, the ignition module locks out with the PURGE light flashing indicating pressure switch fault.

2. Blower energizes.

3. Pressure switch proves blower/vent system operation.
   If the N.O. contacts of the exhaust pressure switch do not close within 5 minutes of the blower being on, the control locks out with the PURGE light flashing indicating pressure switch fault.

4. Blower pre-purge period (5 seconds) indicated by the PURGE LED on the module.

5. Igniter warm up (18 seconds), indicated by the IGNITER LED on the module.

6. Trial for ignition (4 seconds, three trials).
   a) Flame establishing period (2.5 seconds) gas valve and igniter on, indicated by the IGNITER and VALVE LED on the module.
   b) Burner on, flame proving period (1.5 seconds, looking for minimum of 1 micro amps), indicated by the FLAME & VALVE LED on the module.

7. Steady state operation.
   Ignition module monitors:
   - Thermostat circuit.
     - When thermostat opens, gas valve is shut down and post purge begins.
   - Safety circuit.
     - If vent temp switch opens, gas valve is shut down, system will post purge and wait for switch to close before attempting re-ignition.
     - If either pressure switch opens, Gas valve is shut down, Blower is shut down for 30 seconds after which blower is re-energized and system attempts re-ignition starting at pressure switch proving mode.
   -Flame sensor circuit.
     - If flame is lost, gas valve is shut down, system will post purge and system attempts re-ignition starting at pressure switch proving mode.

8. Thermostat satisfies.

9. Burner off.

10. Blower post purge (15 seconds).

Sequence of Operation

For models prior to CF serial numbers

For models prior to CF serial numbers

Lockout Conditions

If normally closed pressure switch contacts open during burner operation, gas valve closes, burner shuts off. Blower restarts after 30 seconds and runs 5 minutes to wait for pressure switch to close. If not, locks out.
The system will go into lock out mode for the following reasons:

- Pressure switches stuck open or closed.
  a) Check for exhaust or intake obstructions.
  b) Check for compliance with vent tables.
  c) Check for evidence of moisture or condensate present in pressure switch tubing or pressure switch.

- No ignition after 3 attempts.
  a) Check gas pressures.
  b) Igniter resistance too high (lower resistance preferred <150 Ohms).
  c) Check venturi screw adjustment (6 ½ turns from bottom)
  d) Flame sense micro amp not present (1 to 5 micro amps required).

Lock out reset is accomplished by shutting OFF the line voltage to the system or opening the 24V thermostat circuit for at least 2 seconds.

System will automatically reset lockout after 1 hour of continuous call for heat from the thermostat. Three ignition trials will be attempted each hour until the thermostat is satisfied.

Ignition Module Specifications

Control Functions:

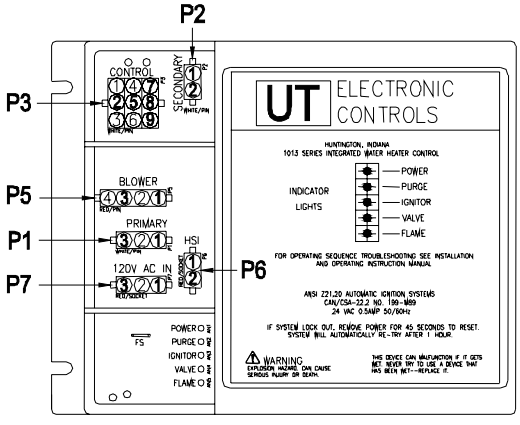
- Ignition & heating functions in response to thermostat.
- Hot surface ignition using a microprocessor to control timing, flame sensing using flame rectification & ignition retries.
- Monitoring of system pressure switches and limit switches.
- Control of gas valve, inducer motor, and hot surface igniter element based on thermostat demand and status of safety inputs.
- Diagnostic indicators to provide information on power to control and control status.
- Non-interchangeable polarized plug-in connectors for all interconnections.

Control Inputs:

- Thermostat call for heat.
- Limit Switch Circuit (normally closed)
- Pressure Switch Circuit (normally open)
- Flame sensing.
- Low voltage supply.
- Line voltage supply.

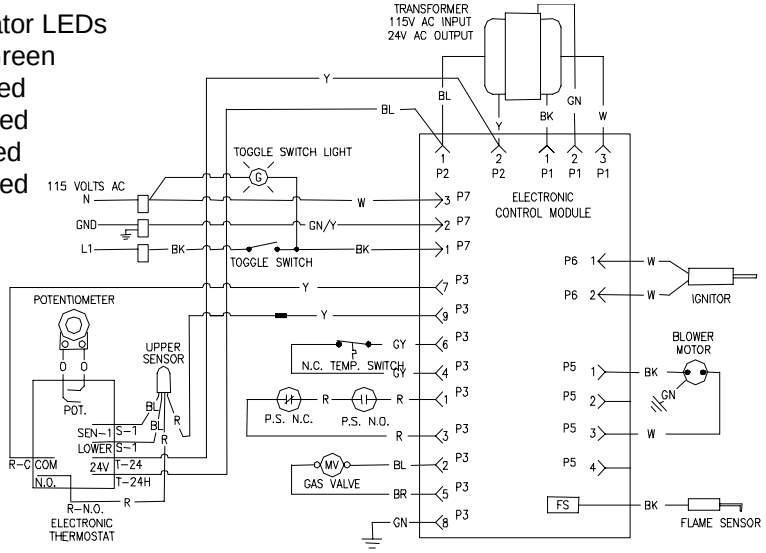
Control Outputs:

- Inducer motor
- Hot surface igniter
- Gas valve
- Status indicator LEDs
  - Power - Green
  - Purge - Red
  - Igniter - Red
  - Valve - Red
  - Flame - Red



IGNITION MODULE

WIRING DIAGRAM



Sequence of Operation

For models starting with CF serial numbers and later.

For models starting with CF serial numbers and later.

1. Thermostat calls for heat.

   Prior to energizing blower, ignition module checks to make sure the vent temperature switch is in the normally closed position. If the vent temperature switch is open, the control waits indefinitely for the temperature switch to close.

2. Blower energizes, pressure switch contacts are normally closed. If the pressure switch contacts are open, blower operates for up to 5 minutes waiting for contacts to close, then blower stops and flashes red PURGE LED indicating lock-out condition.

3. Blower pre-purge period (5 seconds) indicated by PURGE LED on the module

4. Igniter warm up (18 seconds), indicated by the IGNITER LED on the module. **Note: The blocked vent pressure switch must be in the normally closed position for the ignition cycle to start.**

5. Trial for Ignition (4 seconds, 3 trials).
   a) Flame establishing period (2.5 seconds), gas valve and igniter on, indicated by the IGNITER and VALVE LED on the module.
   b) Burner on, flame proving period (1.5 seconds, looking for minimum of 1 micro amps), indicated by the FLAME & VALVE LED on the module.

6. Steady state operation.
   Ignition module monitors:
   - Thermostat circuit.
     - When thermostat opens, gas valve is shut down and post purge begins.
   - Safety circuit.
     - If vent temperature switch opens, gas valve is shut down, system will post purge and wait for switch to close before attempting re-ignition.
     - If the blocked vent pressure switch opens, indicating a blocked exhaust vent condition, the gas valve is shut down, blower shuts down for 30 seconds and is re-energized and system attempts re-ignition if the pressure switch is closed. Blower operates for 5 minutes to wait for pressure switch to close, then shuts off with purge light flashing (lock-out). Will restart in 1 hour to attempt to close the switch and restart ignition sequence.
   - Flame sensor circuit.
     - If flame is lost, gas valve is shut down, system will post purge and system attempts re-ignition.

7. Thermostat satisfied.

8. Burner off.

9. Blower post purge (15 seconds).

Sequence of Operation

For models starting with CF serial numbers and later.

For models starting with CF serial numbers and later.

Lockout Conditions

Lockout conditions:
The system will go into lock out mode for the following reasons:
Blocked vent pressure switch contacts open:
Check for obstruction in exhaust pipe and vent terminal.
Check for blocked condensate trap or drain line. In cold climates, make sure drain is not frozen.
No ignition after 3 attempts:

a) Check inlet and outlet gas pressures (pressure taps located on top of gas valve).
b) Igniter resistance too high (lower resistance preferred < 150 ohms).
c) Misadjusted veturi screw (should be 6.5 turns out from bottom).
d) Flame sense microamp not present (1.0 microamps minimum, should be 5 microamps or more). If burner lit, check flame rod for deposits.
e) Check burner tube condition. Refer to section EF-III for Burner Tube Inspection and Replacement.

Ignition Module Specifications

Control Functions:

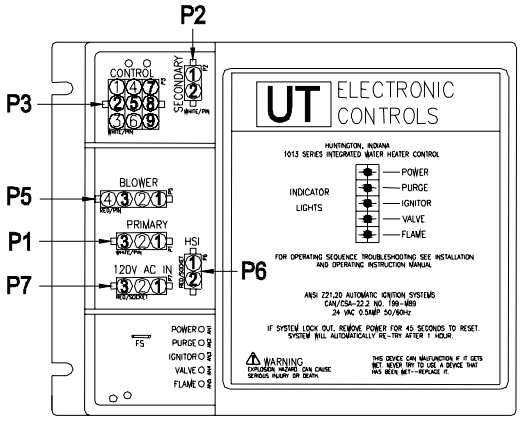
- Ignition & heating functions in response to thermostat.
- Hot surface ignition using a microprocessor to control timing, flame sensing using flame rectification & ignition retries.
- Monitoring of system pressure switches and limit switches.
- Control of gas valve, inducer motor, and hot surface igniter element based on thermostat demand and status of safety inputs.
- Diagnostic indicators to provide information on power to control and control status.
- Non-interchangeable polarized plug-in connectors for all interconnections.

Control Inputs:

- Thermostat call for heat.
- Blocked vent pressure switch (normally closed)
- Flame sensing.
- Low voltage supply.
- Line voltage supply.

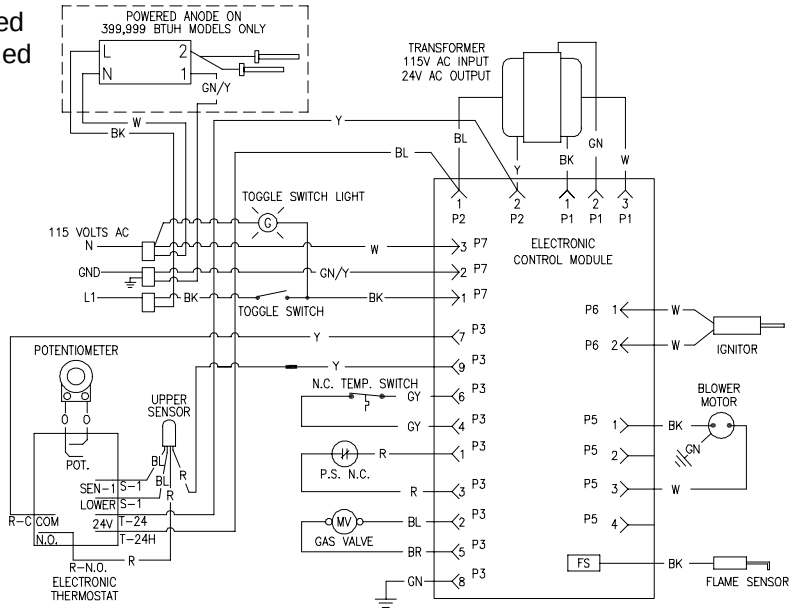
Control Outputs:

- Inducer motor
- Hot surface igniter
- Gas valve
- Status indicator LEDs
  - Power - Green
  - Purge - Red
  - Igniter - Red
  - Valve - Red
  - Flame - Red



IGNITION MODULE

WIRING DIAGRAM



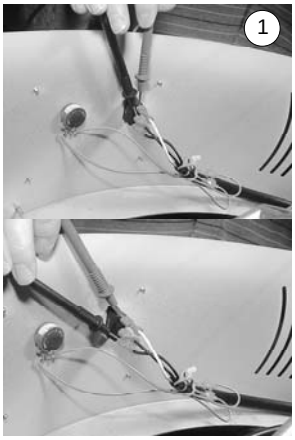
Troubleshooting
System Observation

⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

Is front panel power switch light on, indicating power?
- N → Position front panel power switch to "ON" position.
- Y →

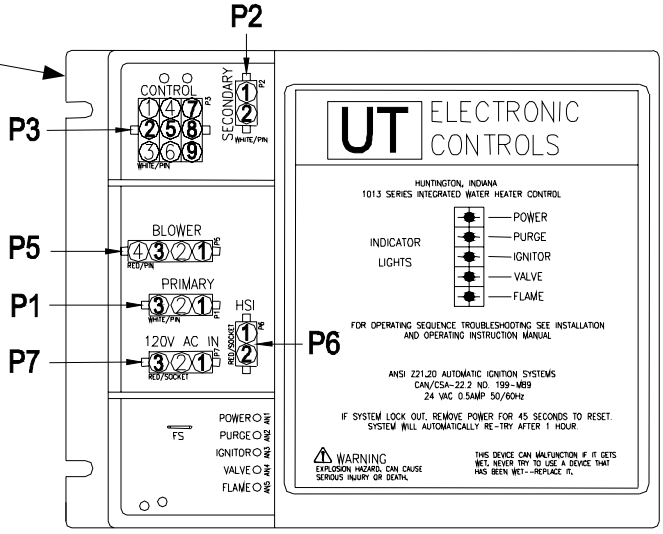
Is there 120VAC across switch? (see photo 1)
- Y → Light burned out, replace switch.
- N →

Is there 120VAC across terminal block? (see photo 2)
- Y → Repair/replace wire harness to switch.
- N → Determine power source problem and correct.



Is ignition module power light on?
- N → Refer to ignition module illustration, is there 120VAC going to module at locations P7(1) and P7(3)?
  - Y → Refer to ignition module illustration, is there 120VAC between P1(1) and P1(3)?
    - Y → Refer to ignition module illustration, is there 24VAC going to module at locations P2(1) and P2(2)?
      - N → Replace transformer. (see pg 40)
    - N → Replace ignition module. (see pg 39)
  - N → Replace ignition module. (see pg 39)
- Y →

IGNITION MODULE



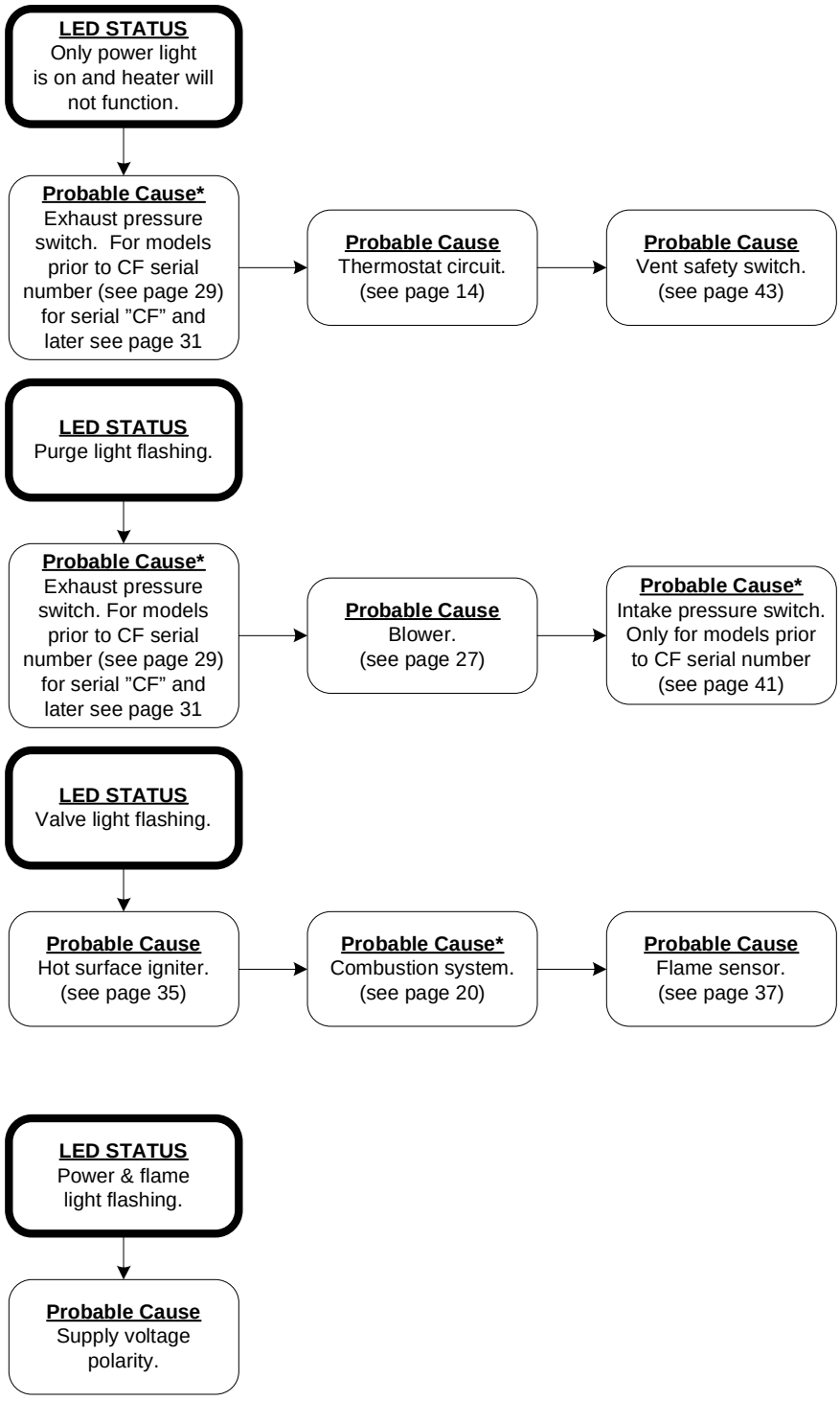
Is ignition module power and flame light flashing?
- Y → Supply voltage polarity is incorrect.
- N →

Reset heater by interrupting power. → Reestablish power and Adjust thermostat to call for heat, tank must be cold. → Allow heater to run through heating cycle. → Did heater complete heating cycle and did blower post purge?
- N → See page 13.
- Y → System is OK.

Troubleshooting
LED status & probable cause

Determine failure mode by observing flashing LED status on ignition module.
LED status and probable cause shown below.

* Denotes conditions that may require the heater to be isolated from the vent system to determine root cause.


LED STATUS
Only power light is on and heater will not function.
Probable Cause*
Exhaust pressure switch. For models prior to CF serial number (see page 29) for serial "CF" and later see page 31
Probable Cause
Thermostat circuit. (see page 14)
Probable Cause
Vent safety switch. (see page 43)
LED STATUS
Purge light flashing.
Probable Cause*
Exhaust pressure switch. For models prior to CF serial number (see page 29) for serial "CF" and later see page 31
Probable Cause
Blower. (see page 27)
Probable Cause*
Intake pressure switch. Only for models prior to CF serial number (see page 41)
LED STATUS
Valve light flashing.
Probable Cause
Hot surface igniter. (see page 35)
Probable Cause*
Combustion system. (see page 20)
Probable Cause
Flame sensor. (see page 37)
LED STATUS
Power & flame light flashing.
Probable Cause
Supply voltage polarity.

SERVICE PROCEDURE EF-I
Thermostat Circuit Testing and Replacement

IMPORTANT NOTE: This procedure assumes a cool tank

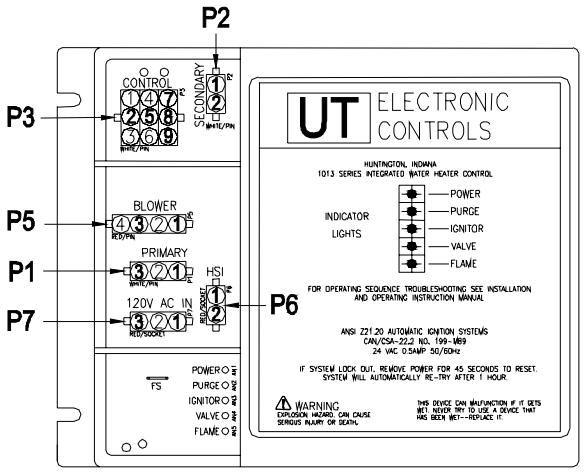
⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

Rotate temperature dial to highest setting.

Refer to ignition module illustration, Is there 24VAC between **P3(7)** and **P3(8)**?

Y → OK, thermostat is calling for heat.

N → Thermostat not calling



IGNITION MODULE

Turn off power to heater.
Disconnect YELLOW and RED wires from the thermostat board at location N.O. and COM shown in photo 3. Use a jumper to connect these two wires together as shown in photo 3a.
Restore power to heater.
Did heater cycle on?

N → See page 16

Y

Check thermostat sensor for proper resistance (OHMS) across blue wires. (See Appendix A, page 15) Are readings correct? (see photo 4)

N → Replace thermostat sensor. (see pg 19)

Y

Check sensor harness continuity. Is there continuity?

N → Replace harness.

Y

Check temperature dial for proper resistance (OHMS) (See Appendix B, page 15) Are readings correct? (see photo 5)

N → Replace temperature dial (potentiometer). (see pg 18)

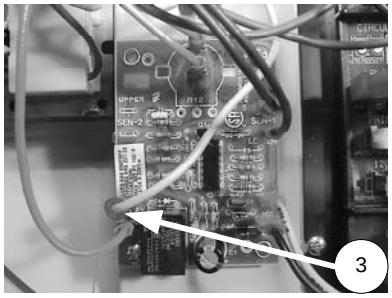
Y

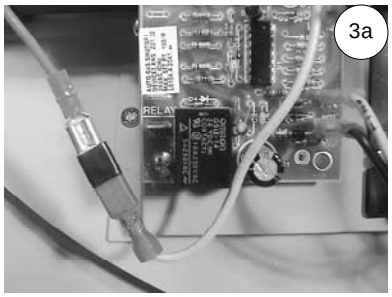
Check temperature dial harness continuity. Is there continuity?

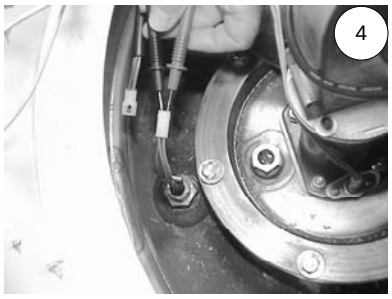
N → Replace harness.

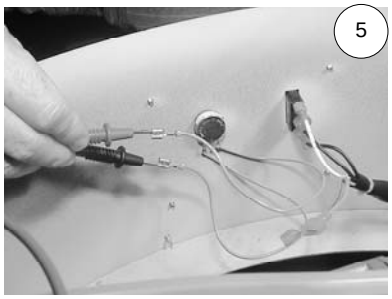
Y

Replace thermostat circuit board. (see pg 17)









APPENDIX - A

Sensor Resistance at Various Temperatures

Be Careful When Making Voltage Measurements or Jumping Terminals Not to Damage or Deform Connectors or Connector Pins.

Draw Water From The T&P Valve. Compare Temperature With Temperature Ohms Chart Below.

Example: If temperature of sensor is 84°F, then the resistance through the sensor would be 8449 (see shaded area).
NOTE: Sensor resistance increases as the temperature falls.

In Degrees F										
°F	0	1	2	3	4	5	6	7	8	9
40	26109	25400	24712	24045	23399	22771	22163	21573	21000	20445
50	19906	19383	18876	18383	17905	17440	16990	16553	16128	15715
60	15314	14925	14548	14180	13823	13477	13140	12812	12494	12185
70	11884	11592	11308	11032	10763	10502	10248	1000	9760	9526
80	9299	9078	8862	8653	8449	8250	8057	7869	7685	7507
90	7333	7165	7000	6839	6683	6531	6383	6238	6098	5961
100	5827	5697	5570	5446	5326	5208	5094	4982	4873	4767
110	4663	4562	4464	4368	4274	4183	4094	4006	3922	3839
120	3758	3679	3602	3527	3453	3382	3312	3244	3177	3112
130	3048	2986	2925	2866	2808	2752	2697	2643	2590	2538
140	2488	2439	2391	2344	2298	2253	2209	2166	2124	2083
150	2043	2004	1966	1928	1891	1856	1820	1786	1753	1720
160	1688	1656	1625	1595	1566	1537	1509	1481	1454	1427
170	1402	1376	1351	1327	1303	1280	1257	1235	1213	1191
180	1170	1150	1129	1110	1090	1071	1053	1035	1017	999
190	982	965	949	933	917	901	886	871	857	842
200	828	814	801	788	775	762	749	737	725	713

APPENDIX - B

Temperature Dial Resistance

Proper Readings Should Be Greater Then 4800 Ohms at Minimum Setting
And Less Then 50 Ohms at Maximum.

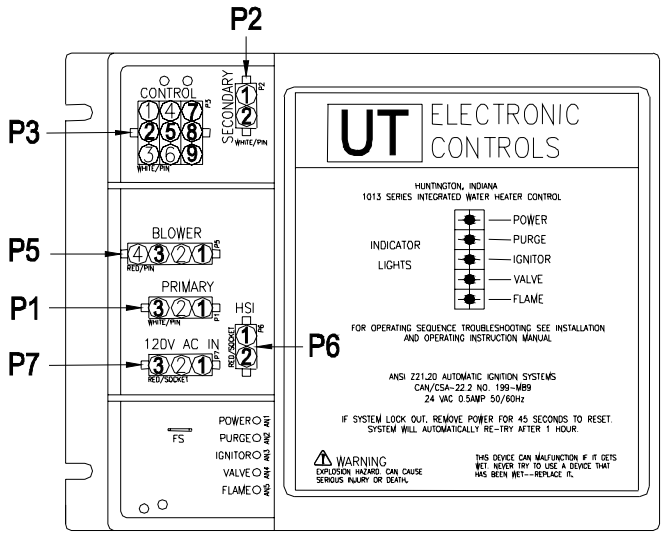
Be Careful When Making Voltage Measurements or Jumping Terminals Not to Damage or Deform Connectors or Connector Pins.

SERVICE PROCEDURE EF-I
Thermostat Circuit Testing and Replacement

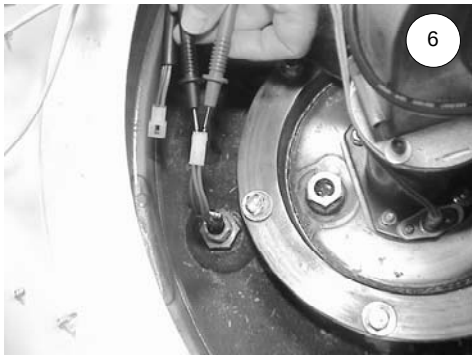
Thermostat circuit.
(continued from page 14)

⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

Refer to ignition module illustration, Is there 120VAC between **P1(1)** and **P1(3)**?
- N → Refer to ignition module illustration, Is there 120VAC between **P7(3)** and **P7(1)**?
  - N → Check AC source to determine why there is no power.
  - Y → Replace ignition module. (see pg 39)
- Y → Refer to ignition module illustration, Is there 22 - 27VAC between **P2(1)** and **P2(2)**?
  - N → Replace transformer. (see pg 40)
  - Y → Refer to ignition module illustration, Is there 24VAC between **P3(9)** and **P2(1)**.
    - Y → Check continuity through ECO, **red wires** of thermostat sensor. Check at temperature less than 160°F Is there continuity? (see photo 6)
      - N → Check wire harness continuity. Replace thermostat sensor or wire harness as necessary. (see pg 19)
      - Y → Replace thermostat circuit board. (see pg 17)
    - N → Replace ignition module. (see pg 39)



IGNITION MODULE



SERVICE PROCEDURE EF-I
Thermostat Circuit Testing and Replacement

Thermostat Board Replacement Procedure

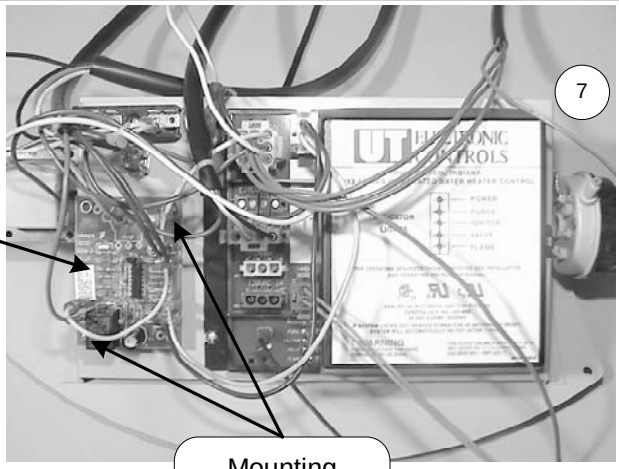
Step 1. Position main power switch to “OFF”

Step 2. Disconnect (unplug) water heater from 120 volt power source.

Step 3. Un-latch and remove top surround cover from top of heater.

Step 4. Locate thermostat board on control panel. (see photo 7)

⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.



Step 5. Carefully disconnect all wires from thermostat board.

Note: it may be necessary to identify wires for proper re-connection.

Step 6. Remove the two screws (Phillips head screw driver) that secure thermostat board to control panel.

Step 7. Install new thermostat board to control panel using screws from step 6.

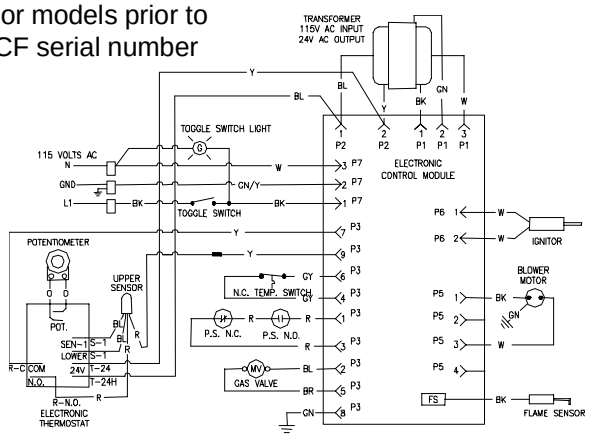
Step 8. Carefully reconnect wiring per the wire diagram below. Reconfirm wire connections are correct prior to putting heater back in service

Step 9. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 10. Replace surround cover on top of heater.

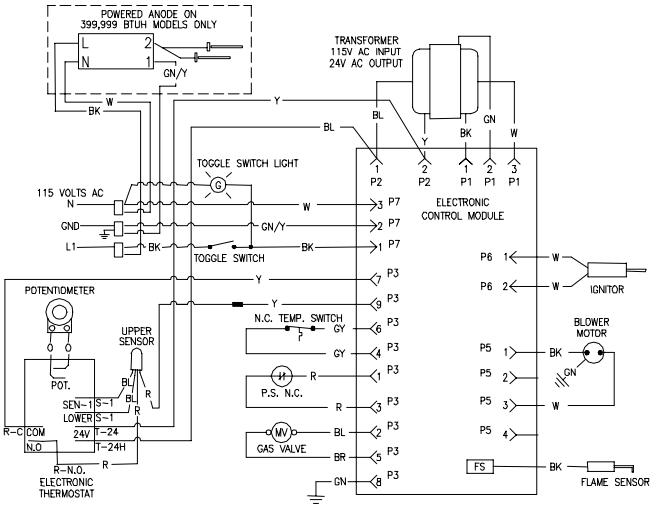
WIRING DIAGRAM

For models prior to CF serial number



WIRING DIAGRAM

For models starting with CF serial numbers and later.



SERVICE PROCEDURE EF-I
Thermostat Circuit Testing and Replacement

Thermostat Potentiometer Replacement Procedure

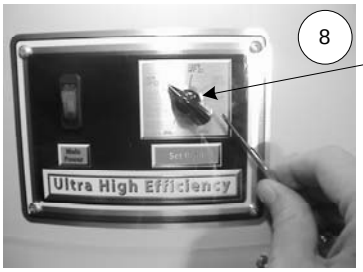
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to “OFF”

Step 2. Disconnect (unplug) water heater from 120 volt power source.

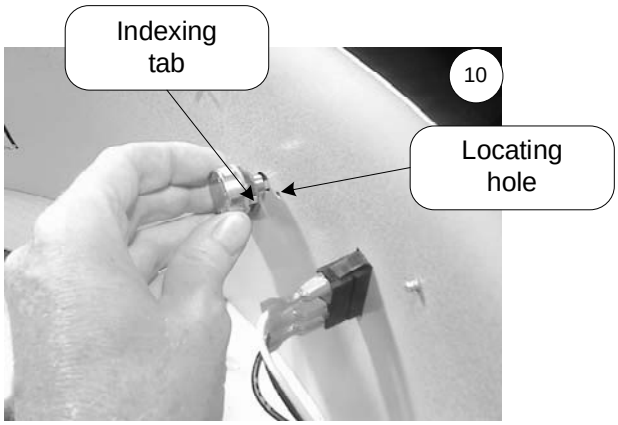
Step 3. Un-latch and remove top surround cover from top of heater.

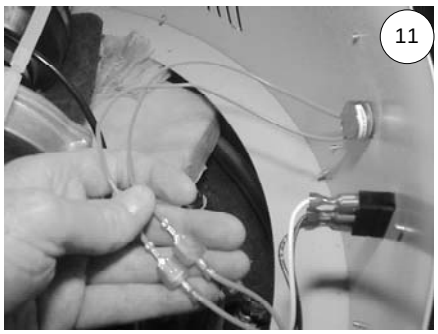
Step 4. Loosen set screw of adjusting knob (small blade screw driver) and remove adjusting knob from potentiometer. (see photo 8)



Step 5. Remove retaining nut (½" wrench) and washer from potentiometer. (see photo 9)

Step 6. From inside of surround area, remove potentiometer with gasket from side of surround. Notice how indexing tab on potentiometer assembles into locating hole of surround. (see photo 10)





Step 7. Disconnect potentiometer wire leads. (see photo 11)

Step 8. Install new potentiometer with gasket into side of surround. Be sure to assemble with indexing tab inserted into locating hole on side of surround (see photo 10).

Step 9. Reconnect wires to potentiometer. Note: Wire leads are interchangeable with either wire.

Step 10. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 11. Replace surround cover on top of heater.

SERVICE PROCEDURE EF-I
Thermostat Circuit Testing and Replacement

Thermostat Sensor (Thermister) Replacement Procedure

⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to “OFF”

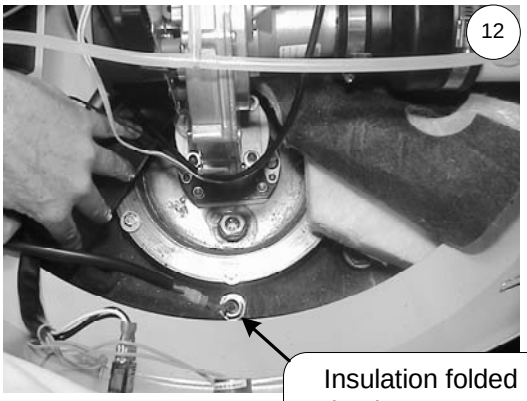
Step 2. Disconnect (unplug) water heater from 120 volt power source.

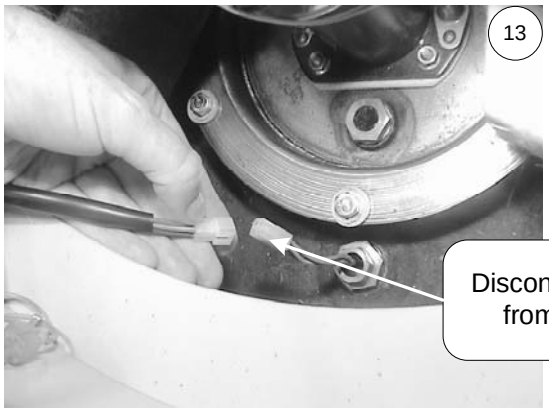
Step 3. Drain heater down to a point below the top of the tank.

Step 4. Un-latch and remove top surround cover from top of heater.

Step 5. Fold back insulation just in front of burner to expose temperature sensor (see photo 12).

Step 6. Disconnect temperature sensor from harness (see photo 13).





Step 7. Remove temperature sensor (1-1/16" hex, deep well socket) from heater.

Note: Using a deep well socket will allow room inside socket for sensor connector and wires.

Step 8. Apply Teflon tape or applicable thread lubricant to threads of new sensor. Install new thermostat sensor and Connect to wire harness from step 6.

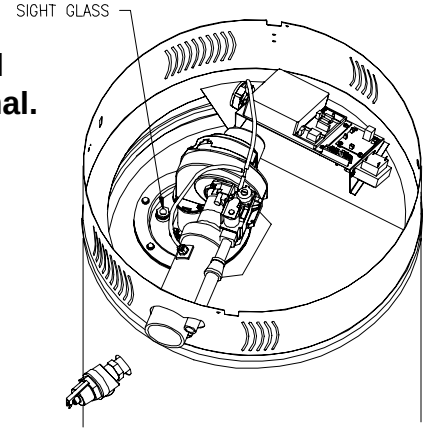
Step 9. Fold insulation back into place. Be sure there are no wires in contact with burner.

Step 10. Restore 120 volt power supply and water supply to water heater, check and repair any leaks found. Confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 11. Replace surround cover on top of heater.

SERVICE PROCEDURE EF-II
Combustion System Testing and Replacement

Observe burner operation through the sight glass located on the combustion insert mounting flange. Normal burner operation should ignite smoothly, without evidence of coughing or huffing upon ignition. The burner flame should be a blue flame near the burner surface in a uniform flame pattern. Occasional yellow or white streaks are normal.



<u>Note:</u> On higher input models using metal fiber mesh burner (serial number "CK" and later) a red glow from the burner surface is normal.

Verify Minimum Gas Supply Piping Requirements of: Minimum 1" NPT for EF100T399, all others use ¾" NPT. (Schedule 40 black Iron Pipe recommended).

N → Reconfigure gas supply piping

Y

With manometer, check inlet gas pressure. Is it stable between 7" & 14" W.C. static? (heater not running) (see illustration 14)

N → Is gas supply pressure regulator adjustable to maintain proper and stable setting?

N → Inadequately sized regulator.

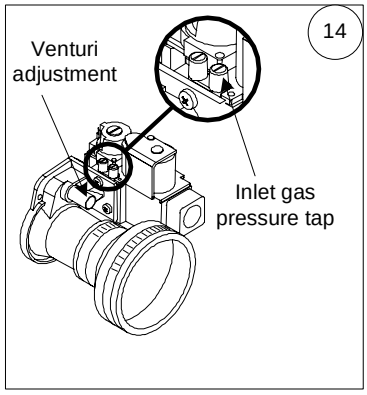
Y → Adjust gas supply regulator

Y

Does inlet gas pressure drop more than 2" W.C. during burner ignition?

Y → (back to Is gas supply pressure regulator adjustable to maintain proper and stable setting?)

N



⚠ WARNING
Removing screw from inlet gas pressure tap will immediately allow gas to flow from pressure tap.

⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

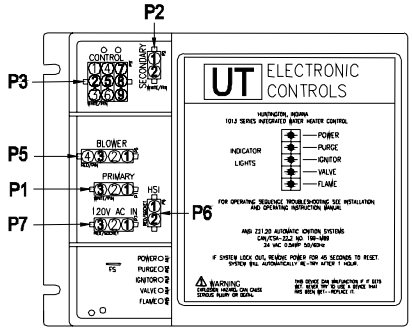
Do you see the igniter glowing through burner site glass during the warm up period?

N → Refer to ignition module illustration below, is there 120VAC across terminals **P6(1)** and **P6(2)?** (Note: Igniter LED must be lit during this check).

N → Replace ignition module. (see pg 39)

Y

Y



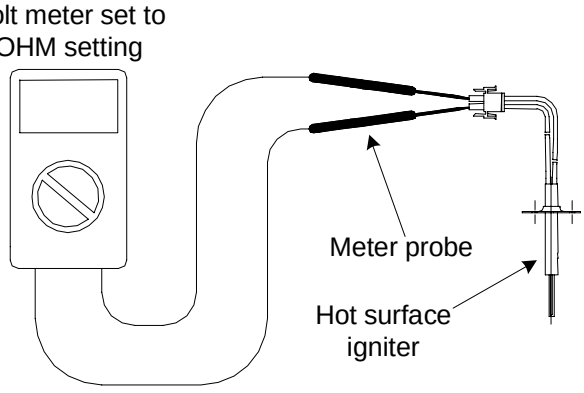
<u>IGNITION MODULE</u>

Is igniter resistance less than 150 Ohms (cold)? (see check igniter illustration)

N → Replace hot surface igniter. (see pg 35)

Y

Proceed to page 21



<u>CHECK IGNITER RESISTANCE</u>

SERVICE PROCEDURE EF-II
Combustion System Testing and Replacement

Observe burner operation through the sight glass located on the combustion insert mounting flange. Normal burner operation should ignite smoothly, without evidence of coughing or huffing upon ignition. The burner flame should be a blue flame near the burner surface in a uniform flame pattern. Occasional yellow or white streaks are normal.

⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Continued from page 20

Refer to ignition module illustration below, is there 24VAC between **P3(2)** and **P3(5)** (blue and brown wires) during the flame establishing period? (Note: Valve LED must be lit during this check)

N → Replace ignition module. (see pg 39)

Y

Can you hear or feel gas valve energize?

N → Replace Rectifier harness and/or gas valve. (see pg 26)

Y

Turn VENTURI set screw clockwise until its bottomed out. Turn screw counter-clockwise 6-½ turns from bottom (see illustration 16). Note: EF100T399 models do not have a venturi screw. The gas regulator setting should be 1 - 1 ¼ turns out from bottom.

Y

Does burner light smoothly, without evidence of coughing or huffing?

N → Check for obstruction at inlet of gas valve. Is inlet free of obstruction?

N → Clear obstruction

N → Inspect burner tube, (see page 25)

Y → Call for technical support

Y

Does flame LED on the module light and stay lit?

Y → Does burner operate normaly until thermostat is satisfied?

N → Y → System OK

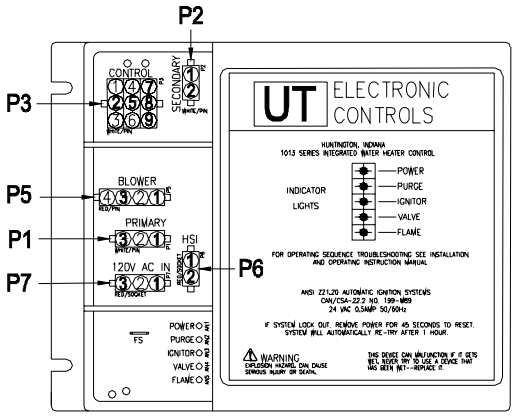
N

Check flame sensor, Is there 1 to 5 micro amps (min.) during 1.5 second flame proving period? (see pg 37)

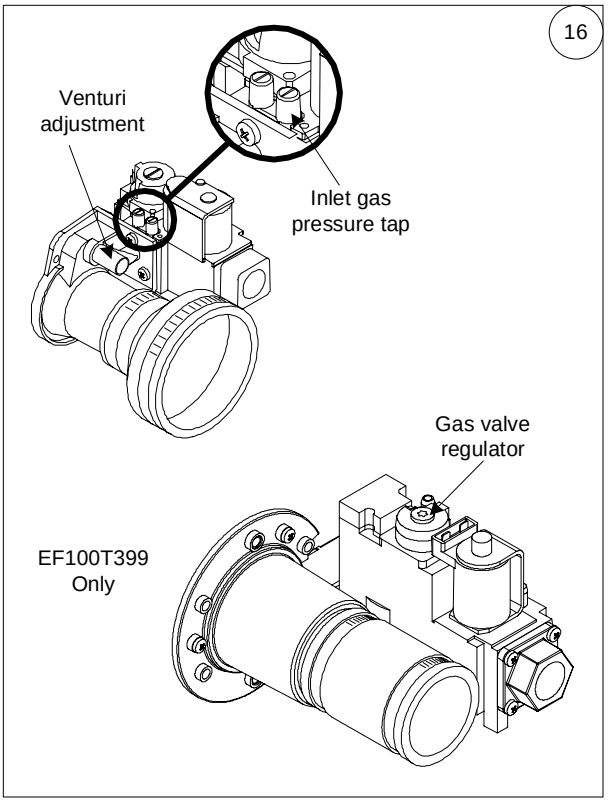
Y → System OK

N

Replace flame sensor (see page 38)



IGNITION MODULE



SERVICE PROCEDURE EF-II
Combustion System Testing and Replacement

⚠ WARNING
Heater components may be HOT when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

Combustion System Removal Procedure

Step 1. Position main power switch to “OFF”.

Step 2. Disconnect (unplug) water heater from 120 volt power source.

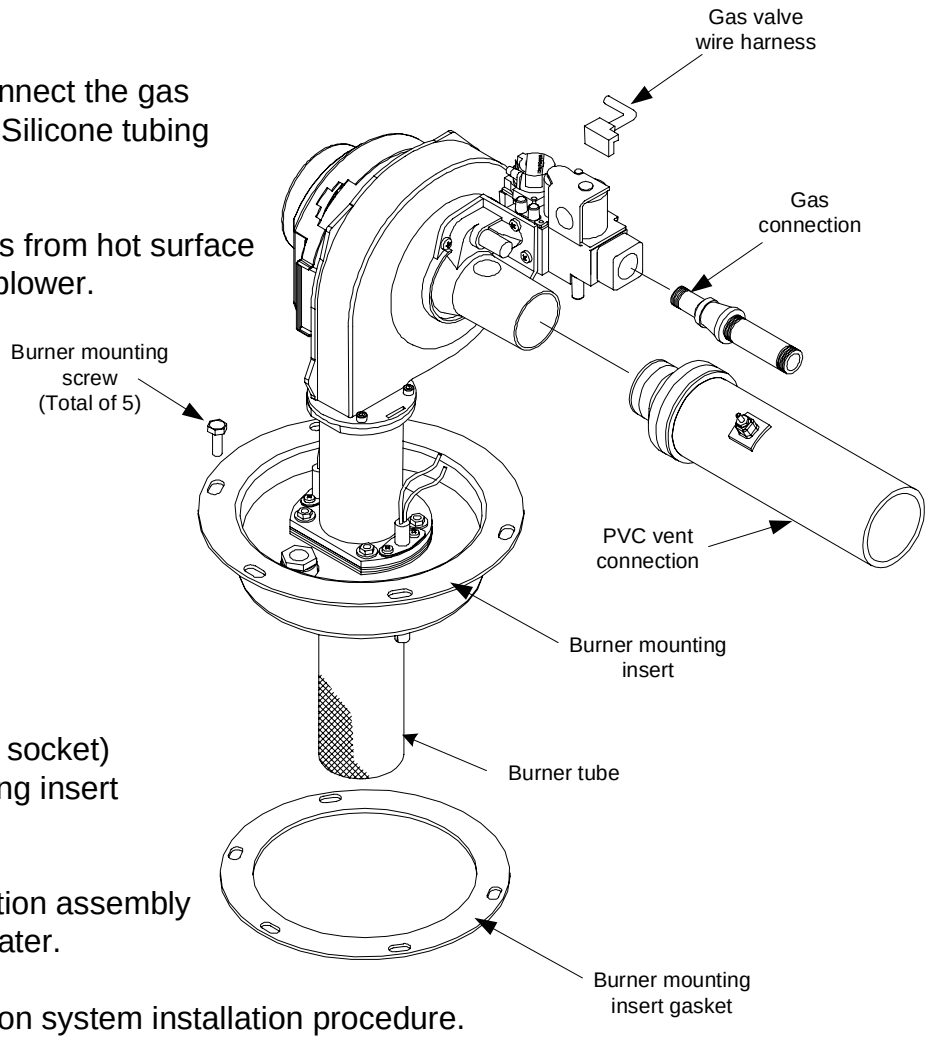
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 3. Turn off gas supply to water heater.

Step 4. Un-latch and remove surround cover from top of heater.

Step 5. From the gas valve, disconnect the gas connection, PVC venting, Silicone tubing and wire harness.

Step 6. Disconnect wire harnesses from hot surface igniter, flame sensor and blower.



Step 7. Remove the 5 screws (½" socket) holding the burner mounting insert in place.

Step 8. Carefully remove combustion assembly with gasket from water heater.

Step 9. See page 23 for combustion system installation procedure.

Combustion System Replacement Procedure

Step 1. Fully inspect burner mounting insert gasket for the following:
- a) Tears
- b) Missing material
- c) Cracks
- d) Dirt or debris
- e) Other imperfections that would inhibit proper seal

If gasket is NOT affected by any of the above, gasket replacement is not required.

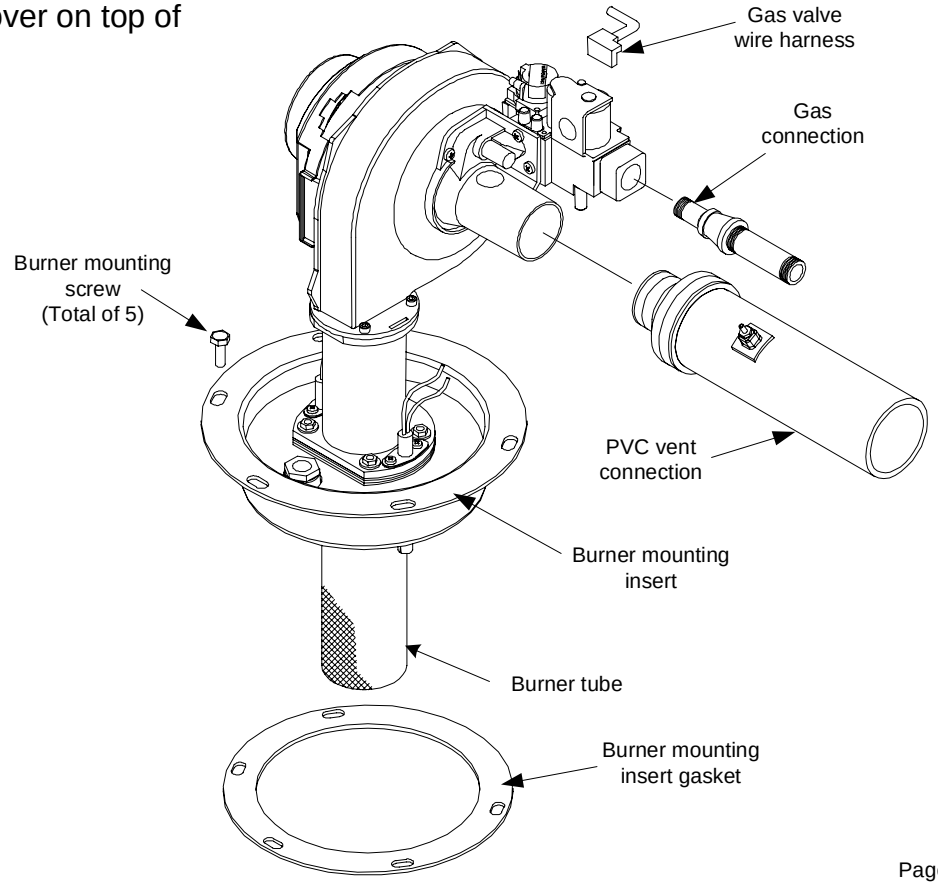
Step 2. Install combustion assembly using new gasket or fully inspected gasket from step 1. Secure combustion assembly at the burner mounting insert using screws from step 6 on page 20. Tighten screws evenly.

Step 3. Reconnect wire harnesses to hot surface igniter, flame sensor, blower and gas valve.

Step 4. Reconnect PVC venting, gas supply and silicone tubing to gas valve. Turn on gas supply to heater and check for gas leaks, repair any gas leaks found.

Step 5. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 6. Replace surround cover on top of water heater.



SERVICE PROCEDURE EF-III
Burner Tube Inspection and Replacement

⚠ WARNING
Heater components may be HOT when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

Burner Tube Removal Procedure

⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

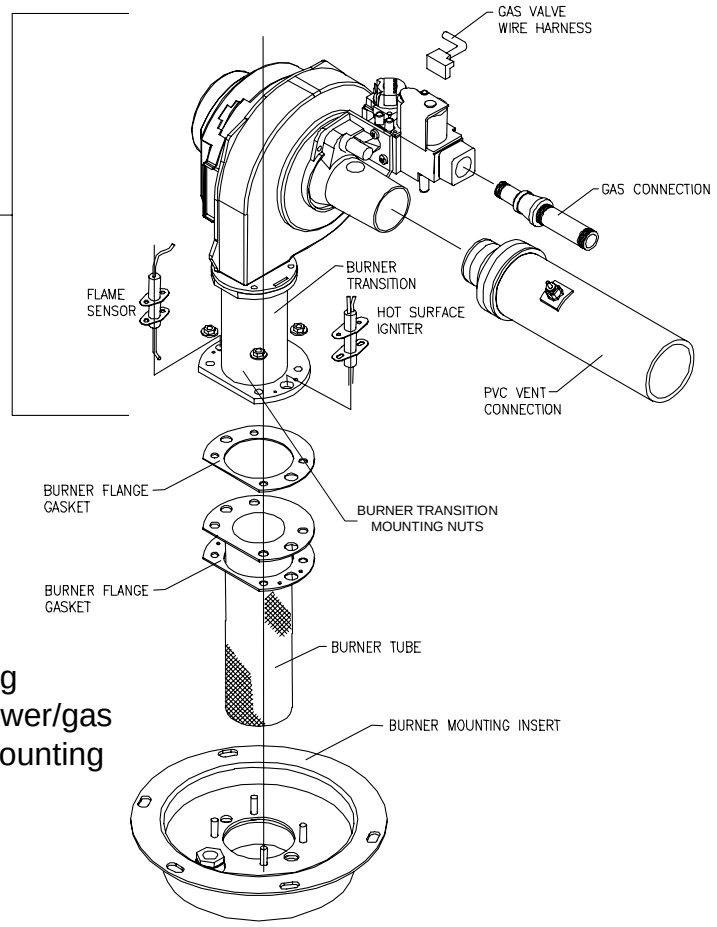
Step 1. Position main power switch to “OFF”.

Step 2. Disconnect (unplug) water heater from 120 volt power source.

Step 3. Turn off gas supply to water heater.

Step 4. Un-latch & remove surround cover from top of heater.

Step 5. From the gas valve, disconnect the gas connection, PVC venting, wire harness and silicone tubing.



Step 6. Disconnect wire harness from blower assembly.

Step 7. Remove the two screws holding each the hot surface igniter and flame sensor in place (long reach magnetic Phillips screw driver). Carefully remove hot surface igniter and flame sensor from combustion assembly.

Step 8. Remove the 4 nuts (7/16" socket) holding the burner transition in place. Lift the blower/gas valve transition assembly from burner mounting insert, remove gasket and set aside.

Step 9. Remove burner tube from burner mounting insert. See page 25 for burner tube inspection procedure.

SERVICE PROCEDURE EF-III

Burner Tube Inspection and Replacement

⚠ WARNING

Heater components may be HOT when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

Burner Tube Inspection

Step 1. **Inspect burner tube as follows (BSI ceramic fiber mesh burner, water heaters prior to serial number "CK") :**

a) Visually inspect ceramic fiber mesh, mesh should be uniform in appearance without large gaps, tears or fraying. Mesh should have uniform pattern allowing for unrestricted gas flow.

b) Gently squeeze burner tube, Burner tube should feel firm without any soft areas around the sides or at the bottom.

c) Visually inspect inside burner tube, Burner tube should be intact with no areas of deterioration. Ports should be free of any debris.

Inspect burner tube as follows (Acotech metal fiber mesh burner, water heaters with "CK" serial number or later).

a) Outer fiber mesh should be uniform with no tears or deterioration.

Step 2. If burner tube is affected by any of the above, replacement is required. Refer to burner tube replacement procedure below.

Burner Tube Replacement Procedure

Note: New metal fiber mesh burner (Acotech) is the replacement burner for the BSI ceramic fiber sock burner. The length of burner will **not** be the same as the previous BSI burner. Provide the model and serial number for the correct replacement burner.

Step 1. Fully inspect burner flange gaskets, igniter and flame sensor gaskets for the following:

a) Tears
b) Missing material
c) Cracks
d) Dirt or debris
e) Other imperfections that would inhibit proper seal

If gaskets are NOT affected by any of the above, gasket replacement is not required.

Step 2. Install burner tube with gaskets into burner mounting insert. Be sure gasket surfaces are free of debris.

Step 3. Reconnect the blower/gas valve/transition assembly to burner mounting insert. Secure using nuts from step 8 on page 24.

Step 4. Carefully reinstall flame sensor with gasket and hot surface igniter with gasket and secure with screws from step 7 on page 24. Reconnect wire harnesses to sensor and igniter.

Step 5. Reconnect wire harnesses to blower motor and to gas valve.

Step 6. Reconnect PVC venting, gas supply and silicone tubing to gas valve. Turn on gas to heater and check for gas leaks, repair any gas leaks found.

Step 7. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 8. Replace surround cover on top of water heater.

Gas Valve Replacement Procedure

⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to “OFF”.

Step 2. Disconnect (unplug) water heater from 120 volt power source.

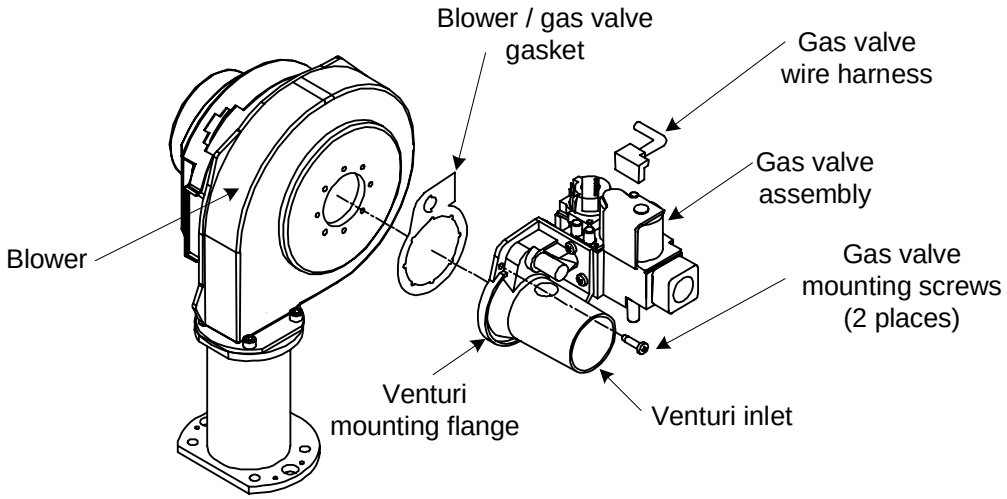
Step 3. Turn off gas supply to water heater.

Step 4. Un-latch & remove surround cover from top of heater.

Step 5. From the gas valve, disconnect the gas connection, PVC venting, wire harness and silicone tubing.

Step 6. Remove the 2 gas valve mounting screws (Torx bit) located at the 11:00 O-clock & 5:00 O-clock position on the venturi mounting flange and remove gas valve from water heater.

Step 7. Remove any residual gasket material from blower and venturi mounting flange.



Step 8. Install new gas valve with new gasket provided. Secure gas valve in place using screws from step 6.

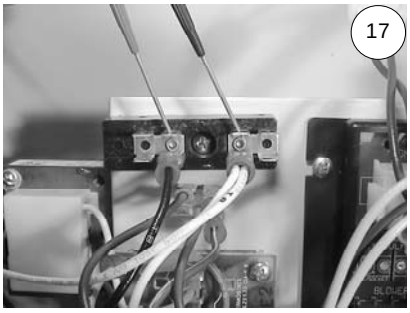
Step 9. Reconnect PVC venting, gas supply, silicone tubing & wire harness to gas valve. Turn on gas supply to heater and check for gas leaks, repair any gas leaks found.

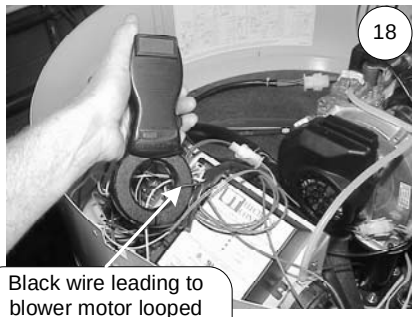
Step 10. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 11. Replace surround cover on top of water heater.

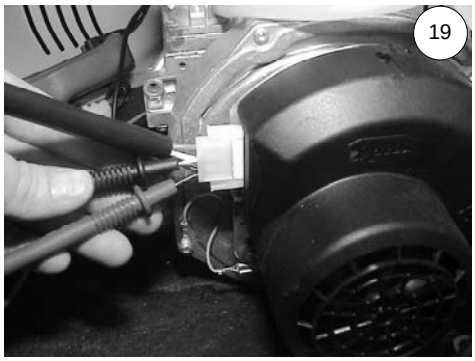
Service Procedure EF-V
Blower Testing and Replacement

Does blower energize?
- Y → Is there 120VAC across the white and black wires at the terminal block ? (see photo 17)
  - Y → Refer to ignition module illustration. Is there 120VAC between **P5(1)** and **P5(3)**?
    - N → Replace ignition module. (see pg 39)
    - Y → Check amp draw through BLACK wire lead of blower motor. Is there .6 to 1 amps? (see photo 18)
      - Y → Is Blower wheel secured to blower motor shaft?
        - Y → Call technical support.
        - N → Replace blower. (see pg 28)
      - N → Replace blower. (see pg 28)
  - N → Determine power source problem and correct
- N → Is there 120VAC across the white and black wires at the terminal block ? (see photo 17)
  - N → Determine power source problem and correct
  - Y → Refer to ignition module illustration. Is there 120VAC between **P5(1)** and **P5(3)**?
    - N → Refer to ignition module, is there 24 VAC between P3(7) and ground?
      - Y → Are safety circuits in normal position? See Safety Circuit Trace on Page 32
        - Y → Replace ignition module. (see pg 39)
        - N → Correct safety circuit problem per safety circuit trace on page 32.
      - N → Thermostat not calling for heat. (see page 14)
    - Y → Is there 120VAC across the white and black wires at the blower? (see photo 19)
      - N → Repair/replace wire harness.
      - Y → Replace blower. (see pg 28)


17


18

Black wire leading to blower motor looped through amprobe.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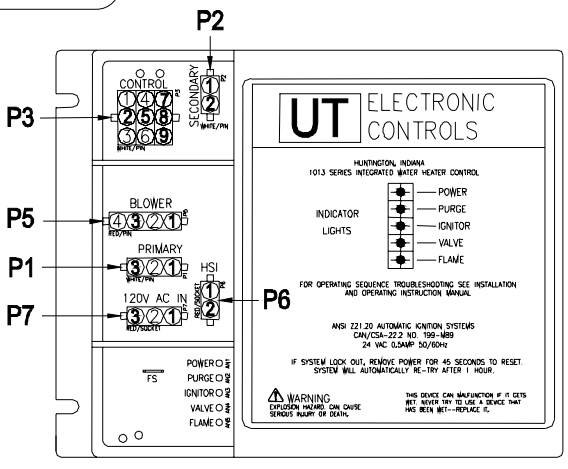


IGNITION MODULE

Blower Replacement Procedure

⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to “OFF”.

Step 2. Disconnect (unplug) water heater from 120 volt power source.

Step 3. Turn off gas supply to water heater.

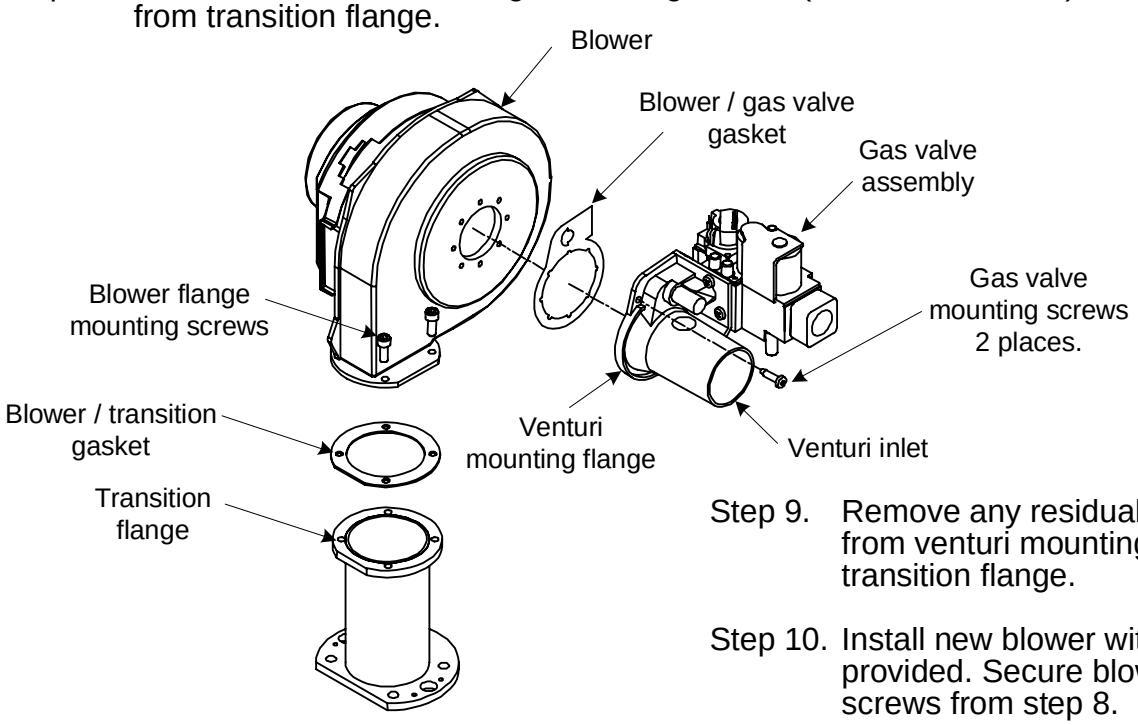
Step 4. Un-latch & remove surround cover from top of heater.

Step 5. Disconnect wire harness from blower.

Step 6. Disconnect intake vent and gas supply from gas valve assembly.

Step 7. Remove the 2 gas valve mounting screws (Torx bit) located at the 11:00 O-clock & 5:00 O-clock position on the venturi mounting flange.

Step 8. Remove The 4 blower flange mounting screws (5/32 Allen wrench) and remove blower from transition flange.



Step 9. Remove any residual gasket material from venturi mounting flange and transition flange.

Step 10. Install new blower with new gasket provided. Secure blower in place using screws from step 8.

Step 11. Reconnect gas valve assembly to blower with new gasket provided. Secure gas valve in place using screws from step 7.

Step 12. Reconnect intake vent and gas line to gas valve assembly and check for gas leaks repair any leaks found.

Step 13. Reconnect wire harness to blower assembly, restore 120 volt power supply & Gas supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 14. Replace surround cover on top of water heater.

Service Procedure EF-VI

Exhaust Pressure Switch Testing and Replacement
For serial numbers prior to "CF"

Sequence of operation:
With the thermostat calling for heat, prior to energizing blower, the ignition module checks the exhaust pressure switch for normal switch position of normally open. If the exhaust pressure switch contacts are closed (not in normal position), the ignition module waits 45 seconds for the pressure switch contacts to open. If the pressure switch contacts do not open after 45 seconds, the ignition module locks out with the PURGE LED flashing indicating a pressure switch fault.

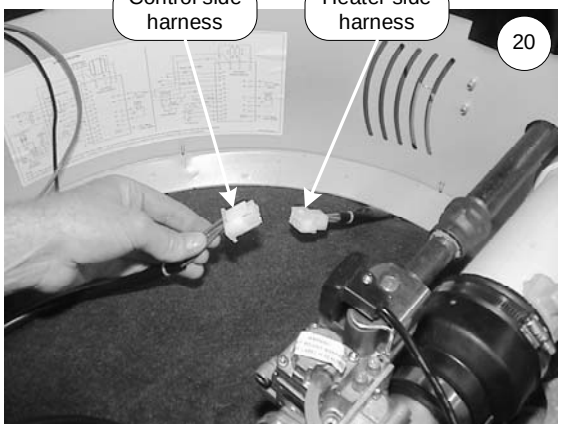
LED Status
Only power LED is on, or Purge LED flashing.

WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

Does blower energize?
- N → Safety Circuit Trace
- Y → Check PURGE LED status.

Safety Circuit Trace

Is there continuity Through GREY wire leads of heater side safety circuit harness? (see photo 20)
- Y → Is there continuity through RED wire leads of heater side safety circuit harness? (see photo 20)
  - N → Safety Circuit OK, See Blower. (Page 27)
  - Y → Check PURGE LED status on ignition module, Flashing after 45 seconds?
    - Y → Replace exhaust pressure switch (see Pg 31)
- N → Depress reset button on vent safety switch. Is there continuity across high limit switch? (see photo 21)
  - N → Replace vent safety switch. (see pg 44)
  - Y → Does heater function?
    - Y → Verify proper switch operation. (see pg 43)
    - N → Call technical support.



Check PURGE LED status.

On within 5 minutes?
- Y → Pressure switch is OK.
- N → Flashing after 5 minutes?
  - N → Call for technical support.
  - Y → Check blower for proper operation (see page 27) Is blower OK?
    - N → Correct blower problem (see page 27)
    - Y → Refer to "Check Collector Pressure" (see Pg 29)

Service Procedure EF-VI

Exhaust Pressure Switch Testing and Replacement
For serial numbers prior to "CF"

Check Collector Pressure

Check exhaust collector pressure at the exhaust collector pressure tap location (see illustration below). Is there positive pressure equal to or greater than pressure switch settings below?

EXHAUST PRESSURE SWITCH SETTINGS

EF(60,100)T199	+2.58"	W.C.
EF100T150	+1.50"	W.C.(see note 1)
EF60T150,EF100T250	+1.22"	W.C.
EF60T125	+2.08"	W.C.
EF100T300	+0.55"	W.C.(see note 2)

Note 1: +5.6" W.C. on serials prior to AH5039107
Note 2: +0.8" W.C. on serials prior to AK5288269

Y → With monometer, take a reading at the ***exhaust tube pressure tap*** location. Is value negative (-)? (see illustration below).

N → Is exhaust venting system blocked or obstructed?

Y → Clear obstruction. Determine cause and correct.

N → Is vent system total length compliant with vent tables in the instruction manual?

N → Reconfigure vent system to be compliant with vent tables on page 7.

Y → Replace exhaust pressure switch. (see pg 31)

Y → Replace exhaust pressure switch. (see pg 31)

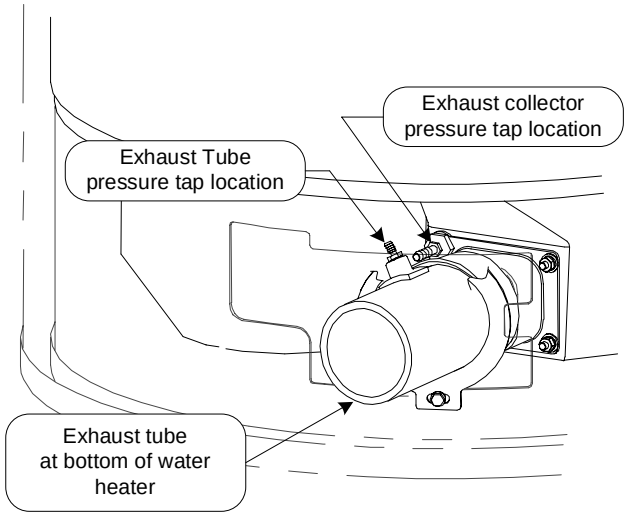
N → Inspect the area housing the combustion system and control panel located at the top of the heater. Does the area show signs of corrosion and/or exssesive heat?

Y → Call for technical support

N → Remove combustion assembly (see pg 22) Inspect combustion chamber for blockage or debris accumulation

Y → Clear obstruction. Determine cause and correct.

N → Call for technical support



Service Procedure EF-VI

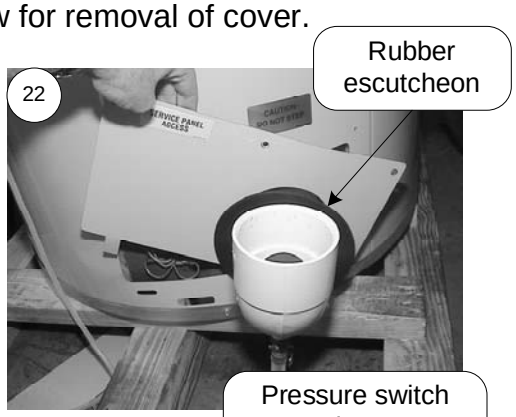
Exhaust Pressure Switch Testing and Replacement
For serial numbers prior to "CF"

Exhaust Pressure Switch Replacement Procedure

Step 1. Position main power switch to "OFF" position.

Step 2. Loosen adhesive backed rubber escutcheon from service panel access cover and slide escutcheon back along exhaust pipe to allow for removal of cover.

Step 3. Remove screws from service panel access cover (¼" nut driver) and remove cover from heater. (see photo 22)

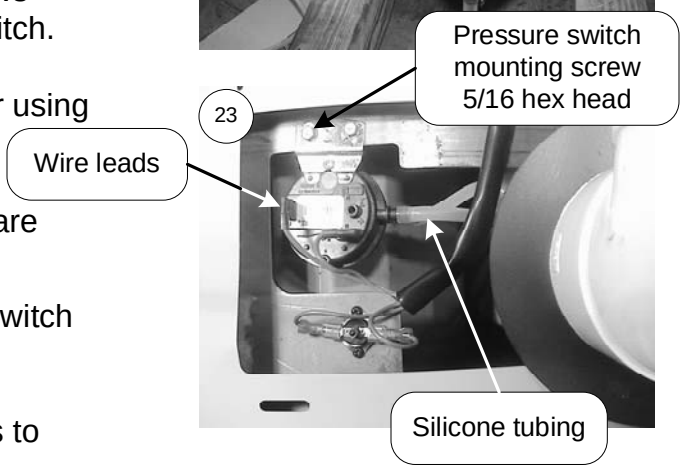


Step 4. Disconnect silicone tubing and wire leads from pressure switch. (see photo 23)

Step 5. Remove pressure switch mounting screws (5/16" wrench) and remove pressure switch.

Step 6. Assemble new pressure switch to heater using screws from step 5.

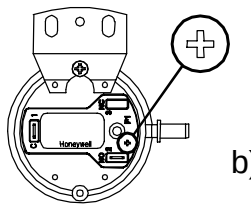
Step 7. Reconnect wire leads. Note: wire leads are interchangeable with either terminal.



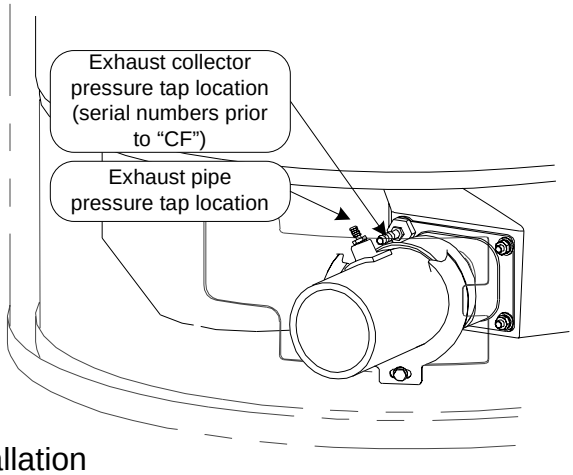
Step 8. Reconnect silicone tubing to pressure switch as follows:

a) Exhaust pipe tubing connects to negative (-) side of switch identified by the (-) symbol located on switch.

b) Exhaust collector tubing connects to positive (+) side of switch identified by the (+) symbol located on the switch.



Example of switch showing positive side identifier



Step 9. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 10. Reinstall service panel access cover and rubber escutcheon.

Service Procedure EF-VI

Blocked Vent Pressure Switch Testing and Replacement for serial number "CF" and later

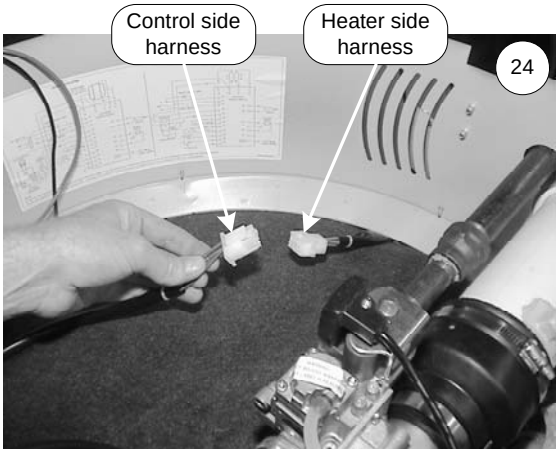
Sequence of operation:
The blocked vent pressure switch monitors the pressure in the exhaust tube. The switch contacts are normally closed and will not open unless there is a blockage in the exhaust venting or terminal (snow, ice, debris). If the blocked vent pressure switch contacts open after the thermostat initiates the blower, the blower will remain on for to 5 minutes waiting for the contacts to close. If the contacts remain open, the blower will stop and the PURGE LED will flash.

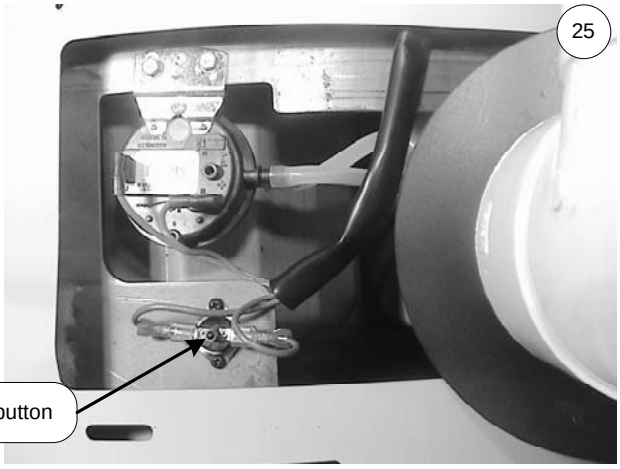
LED Status
Only power LED is on, or Purge LED flashing.

⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

Safety Circuit Trace

Does blower energize?
- N → Is there continuity Through GREY wire leads of heater side safety circuit harness? (see photo 24)
  - Y → Is there continuity through RED wire leads of heater side safety circuit harness? (see photo 24)
    - Y → Safety Circuit OK, See Blower. (Page 29)
    - N → Check PURGE LED status on ignition module, Flashing after 5 minutes?
      - → Replace exhaust pressure switch (see Pg 34)
  - N → Depress reset button on vent safety switch. Is there continuity across high limit switch? (see photo 25)
    - N → Replace vent safety switch. (see pg 44)
    - Y → Does heater function?
      - N → Call technical support.
      - Y → Verify proper switch operation. (see pg 43)
- Y → Check PURGE LED status.
  - On within 5 minutes?
    - Y → Pressure switch is OK.
    - N → Flashing after 5 minutes?
      - N → Call for technical support.
      - Y → Check blower for proper operation (see page 27) Is blower OK?
        - N → Correct blower problem (see page 27)
        - Y → Refer to "Check Collector Pressure" (see Pg 33)



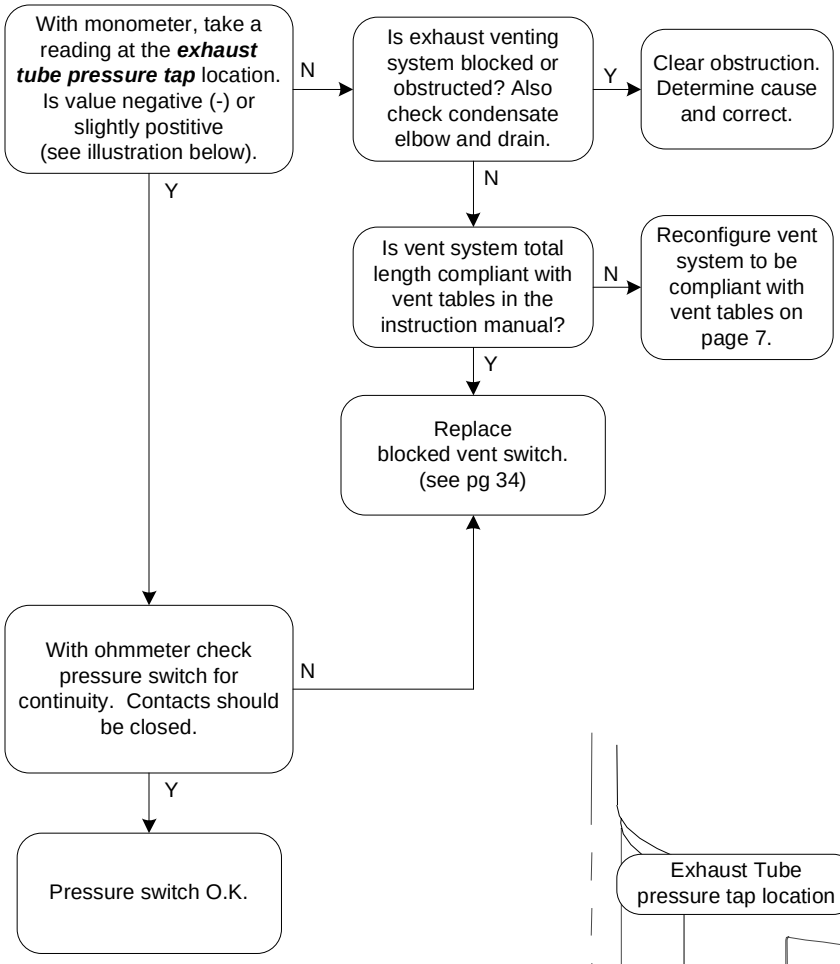


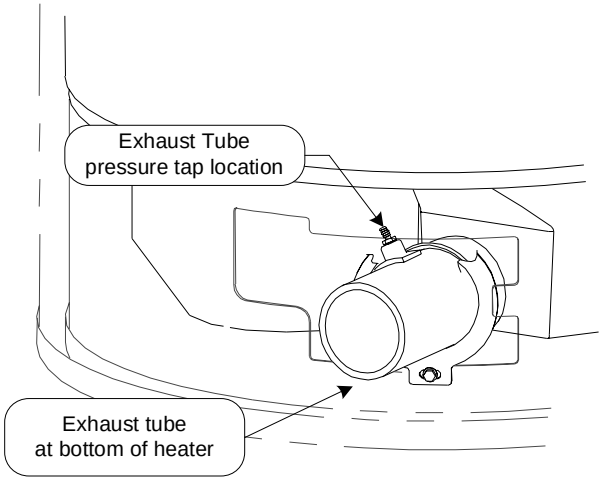
Note: The blocked vent pressure switch must be used with the revised ignition control, identified with a yellow label.

Service Procedure EF-VI

Blocked Vent Pressure Switch Testing and Replacement for serial number “CF” and later

Check Exhaust Tube Pressure


With monometer, take a reading at the ***exhaust tube pressure tap*** location. Is value negative (-) or slightly postitive (see illustration below).
N
Is exhaust venting system blocked or obstructed? Also check condensate elbow and drain.
Y
Clear obstruction. Determine cause and correct.
N
Y
Is vent system total length compliant with vent tables in the instruction manual?
N
Reconfigure vent system to be compliant with vent tables on page 7.
Y
Replace blocked vent switch. (see pg 34)
Y
With ohmmeter check pressure switch for continuity. Contacts should be closed.
N
Y
Pressure switch O.K.



Service Procedure EF-VI

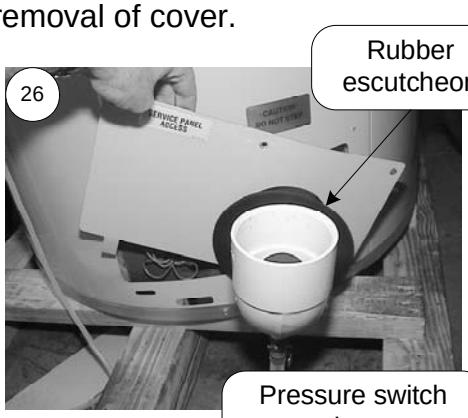
Blocked vent Switch Testing and Replacement
For serial number “CF” or later

Exhaust Pressure Switch Replacement Procedure

Step 1. Position main power switch to “OFF” position.

Step 2. Loosen adhesive backed rubber escutcheon from service panel access cover and slide escutcheon back along exhaust pipe to allow for removal of cover.

Step 3. Remove screws from service panel access cover (¼" nut driver) and remove cover from heater. (see photo 26)



Step 4. Disconnect silicone tubing and wire leads from pressure switch. (see photo 27)

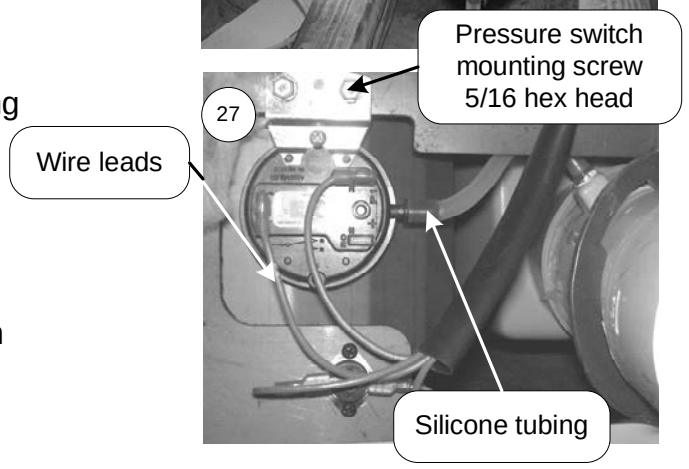
Step 5. Remove pressure switch mounting screws (5/16" wrench) and remove pressure switch.

Step 6. Assemble new pressure switch to heater using screws from step 5.

Step 7. Reconnect wire leads. Note: wire leads are interchangeable with either terminal.

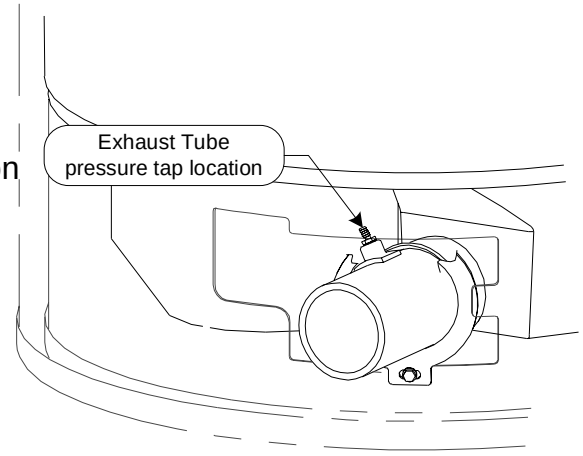
Step 8. Reconnect silicone tubing to pressure switch as follows:

a) Exhaust pipe tubing connects to single tap located on switch



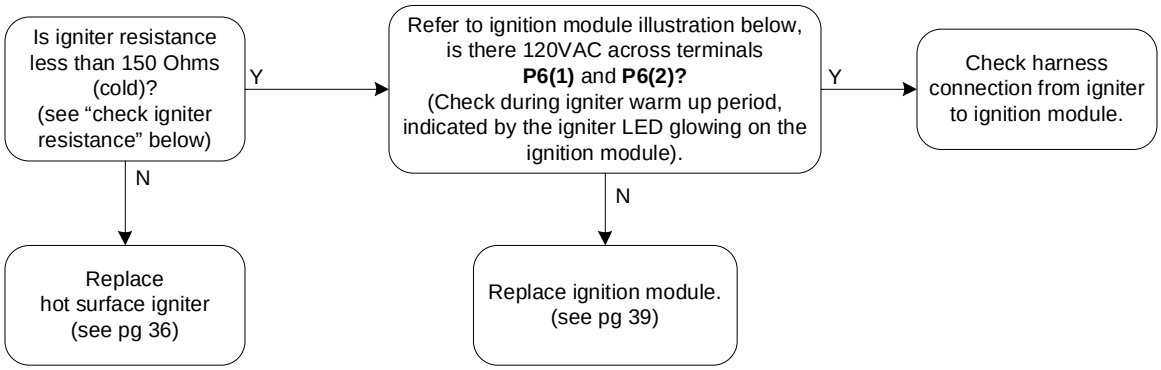
Step 9. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

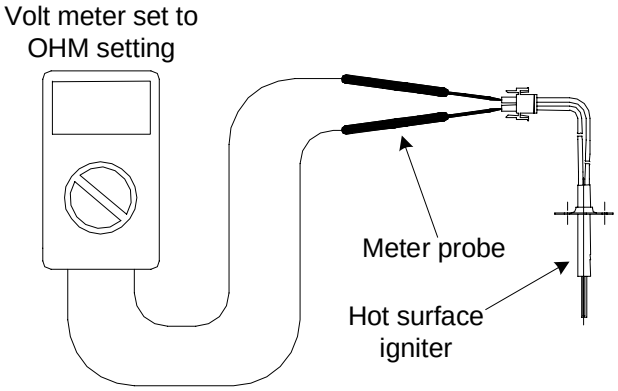
Step 10. Reinstall service panel access cover and rubber escutcheon.



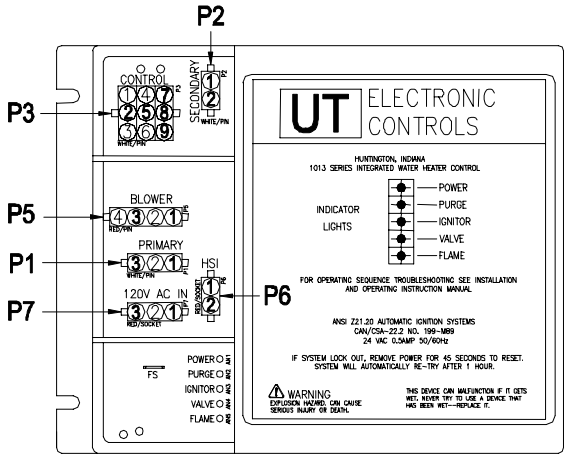
Hot surface Igniter Testing Procedure

⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury. Igniter may be too hot to handle, take necessary precautions


Is igniter resistance less than 150 Ohms (cold)? (see "check igniter resistance" below)
Y
Refer to ignition module illustration below, is there 120VAC across terminals **P6(1)** and **P6(2)?** (Check during igniter warm up period, indicated by the igniter LED glowing on the ignition module).
Y
Check harness connection from igniter to ignition module.
N
Replace hot surface igniter (see pg 36)
N
Replace ignition module. (see pg 39)



CHECK IGNITER RESISTANCE



IGNITION MODULE

Hot surface Igniter Replacement Procedure

Step 1. Position main power switch to “OFF”

Step 2. Disconnect (unplug) water heater from 120 volt power source.

Step 3. Un-latch & remove surround cover from top of heater.

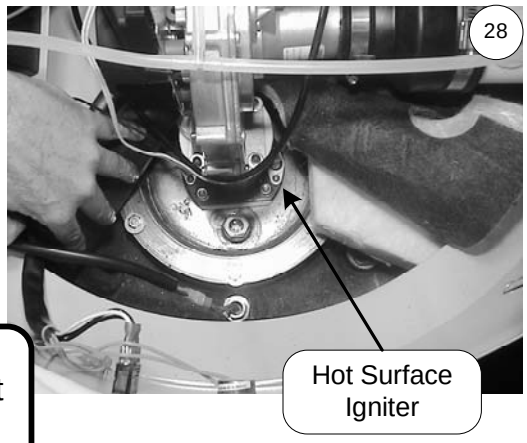
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 4. Fold back insulation in front of combustion assembly to expose hot surface igniter. (see photo 28)

Step 5. Disconnect igniter wire leads from heater harness.

Step 6. Remove the 2 igniter mounting screws (magnetic tip, long reach Phillips screw driver) and remove igniter and gasket from transition base flange.

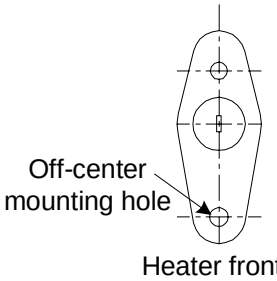
Step 7. Remove any residual gasket material from transition base flange.

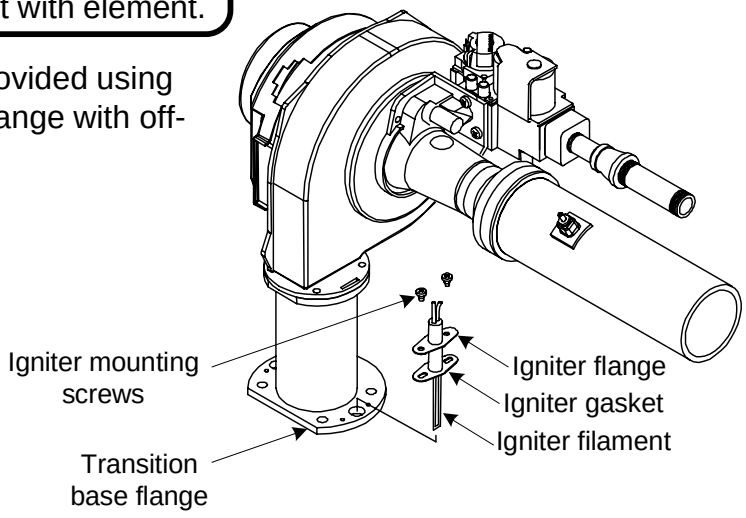


Note:
New replacement igniter will not have a shield over element. Handle carefully to prevent breakage.

Note:
Do not handle igniter element or allow foreign material to come in contact with element.

Step 8. Install new igniter with new gasket provided using screws from step 5. Arrange igniter flange with off-center hole towards front of heater.





Step 9. Reconnect igniter wire harness.

Step 10. Fold insulation back into place. Be sure no wires are in contact with burner flange.

Step 11. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

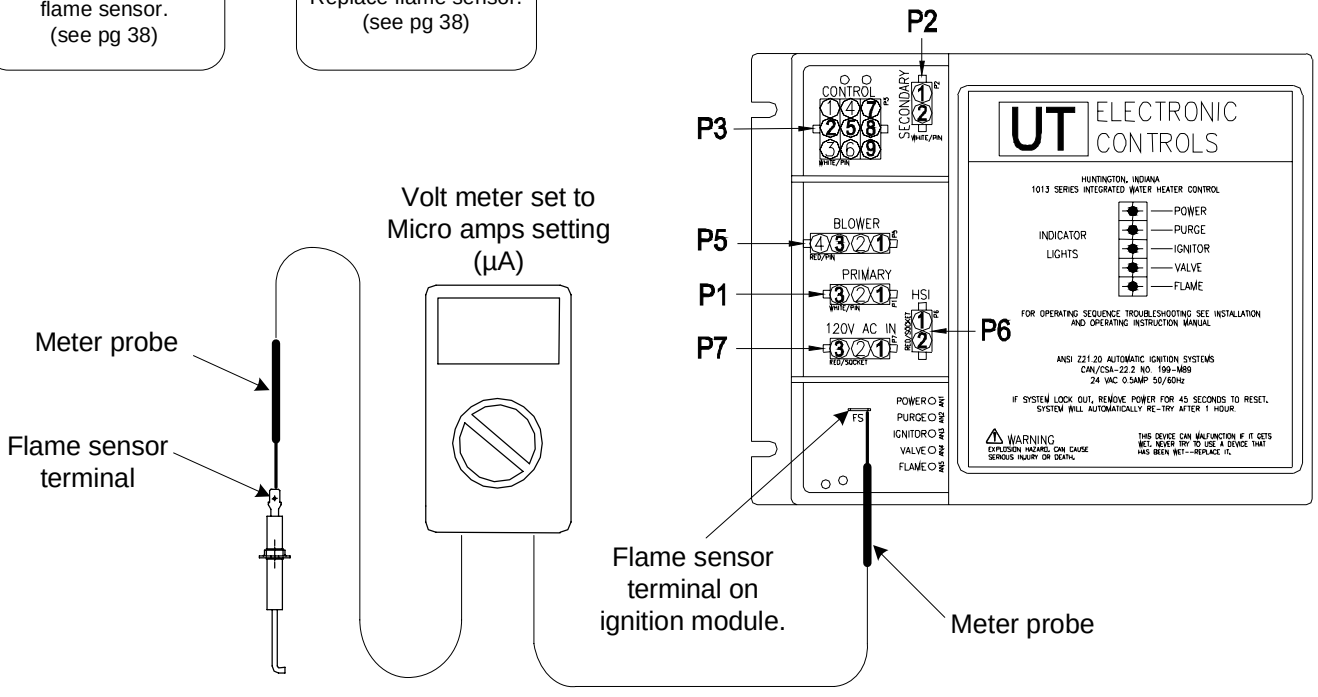
Step 12. Replace surround cover on top of water heater.

Service Procedure EF-VIII
Flame Sensor Testing and Replacement

Flame Sensor Testing Procedure

⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury. Flame sensor may be too hot to handle, take necessary precautions

Refer to illustration below, is there a minimum of 1 micro amp during 1.5 second flame proving period?
- Y → Refer to ignition module illustration below. Is there 24 volts AC at locations P3(2) & P3(5)? 24 volts should maintain beyond the 1.5 second flame proving period.
  - Y → Flame sensing circuit OK
  - N → Call for technical support
- N → With flame sensor Disconnected from ignition module, check continuity to ground. Is there continuity to ground?
  - Y → Replace flame sensor with gasket and/or wire lead. (see pg 38)
  - N → Remove flame sensor from heater. Check continuity from tip of flame sensor to end of wire lead. Is there continuity?
    - N → Replace flame sensor with gasket and/or wire lead. (see pg 38)
    - Y → Is flame sensor free of oxidation?
      - Y → Is ceramic of flame sensor cracked?
        - N → Call for technical support
        - Y → Replace flame sensor. (see pg 38)
      - N → Clean or replace flame sensor. (see pg 38)



Flame Sensor Replacement Procedure

⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to “OFF”

Step 2. Disconnect (unplug) water heater from 120 volt power source.

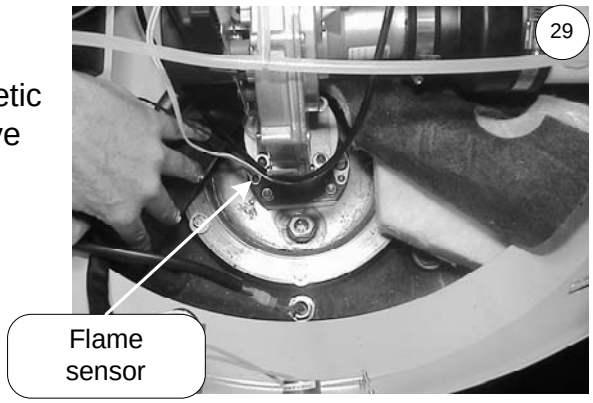
Step 3. Un-latch & remove surround cover from top of heater.

Step 4. Fold back insulation in front of combustion assembly to expose flame sensor. (see photo 29)

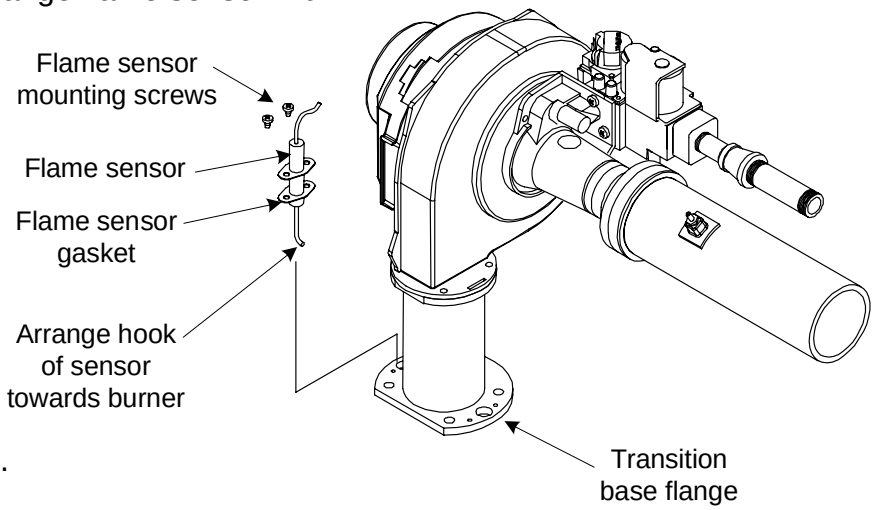
Step 5. Disconnect wire lead from flame sensor.

Step 6. Remove the 2 sensor mounting screws (magnetic tip, long reach Phillips screw driver) and remove flame sensor & gasket from transition base flange.

Step 7. Remove any residual gasket material from transition base flange.



Step 8. Install new flame sensor with new gasket provided using screws from step 6. Arrange flame sensor with hook towards burner.



Step 9. Reconnect flame sensor wire.

Step 10. Fold insulation back into place. Be sure no wires are in contact with burner flange.

Step 11. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 12. Replace surround cover on top of water heater.

Ignition Module Replacement Procedure

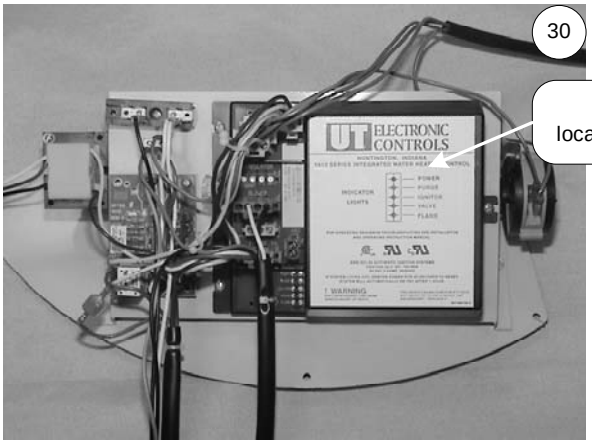
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to “OFF”.

Step 2. Disconnect (Unplug) water heater from 120 Volt power source.

Step 3. Un-latch & remove surround cover from top of water heater.

Step 4. Locate Ignition module on control panel inside surround area. (see photo 30)



Note: Replacement module works on all EF models prior to and later than “CF” serial numbers

Step 5. Carefully disconnect all wire harness connection to ignition module. Connection are non-interchangeable to insure proper reinstallation.

Step 6. Remove the 3 screws (Phillips screw driver) holding the ignition module in place and remove ignition module from control panel.

Step 7. Install new ignition module and secure in place with screws from step 6.

Step 8. Carefully reconnect all wire harness connection to ignition module. Connection are non-interchangeable to insure proper reinstallation.

Step 9. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 10. Replace surround cover on top of water heater.

Transformer Replacement Procedure

⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

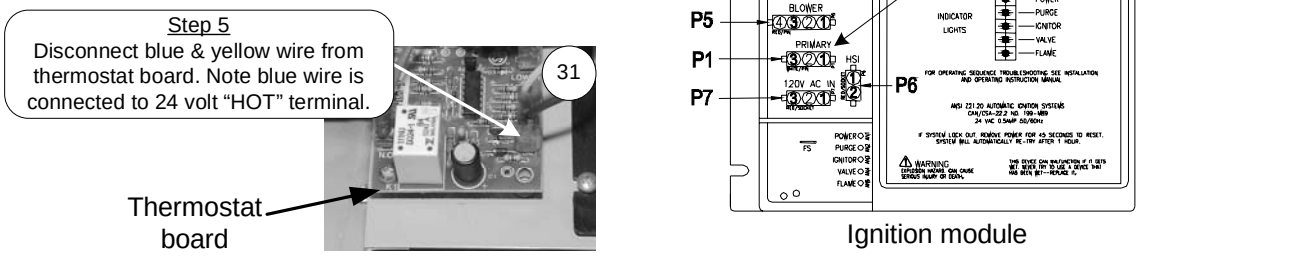
Step 1. Position main power switch to “OFF”.

Step 2. Disconnect (Unplug) water heater from 120 Volt power source.

Step 3. Un-latch & remove surround cover from top of water heater.

Step 4. Refer to ignition module illustration below, Disconnect wire harness P1 labeled “PRIMARY” and P2 labeled “SECONDARY” from ignition module.

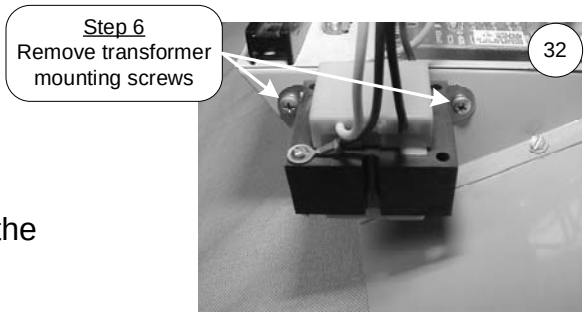
Step 5. Disconnect secondary leads (blue & yellow wire) from thermostat board. Note the blue wire is connected to 24 volt “HOT” terminal. (see photo 31)



Ignition module

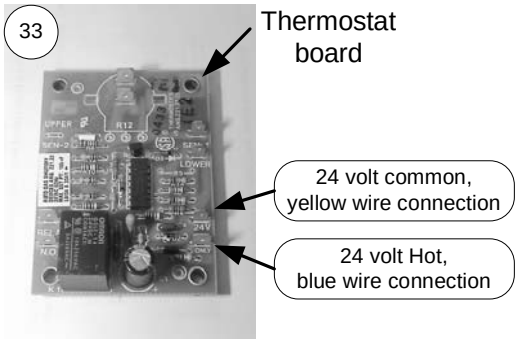
Step 6. Remove the 2 screws (short Phillips screw driver) holding the transformer in place and remove transformer from control panel. (see photo 32)

Step 7. Install new transformer and secure in place with screws from step 6.



Step 8. Reconnect wire harness P1 & P2, connections are non-interchangeable to insure proper reconnection.

Step 9. Reconnect blue & yellow wire leading from the P2 connection on ignition module to thermostat board. Note the blue wire must connect to the 24 volt “HOT” terminal. (see photo 33)



Step 10. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 11. Replace surround cover on top of water heater.

Service Procedure EF-XI

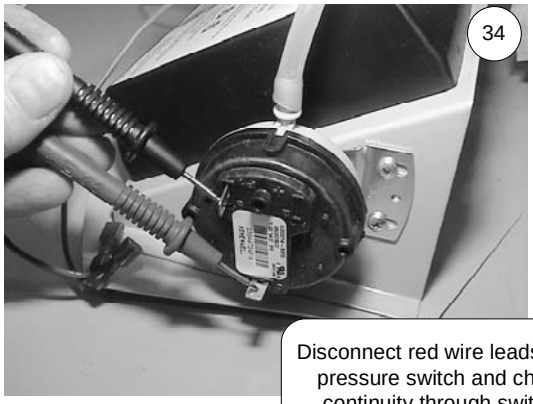
Intake Pressure Switch Testing and Replacement

Used on EF water heaters prior to "CF" serial number.

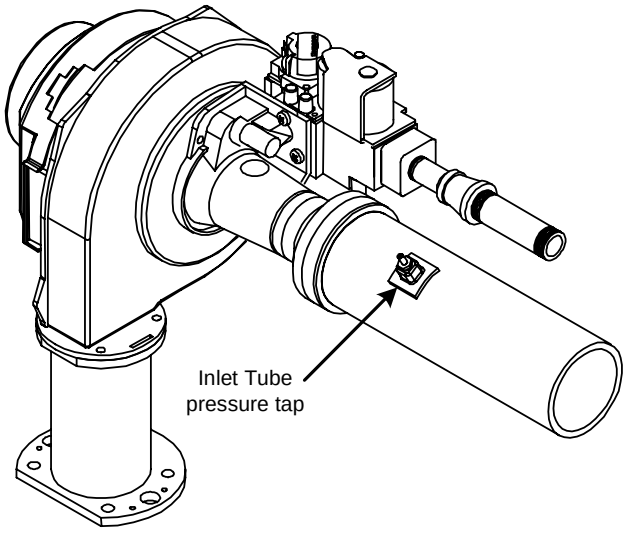
Notice:
The intake pressure switch is not used on serial number "CF" and later.

⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.

Does Blower Energize?
- N → Is there continuity through the normally closed intake pressure switch? (see photo 31)
  - N → Replace intake pressure switch. (see pg 42)
  - Y → See Vent Safety Switch (page 43) or Exhaust Pressure switch (page 31) or Blower testing (page 27)
- Y → Does purge LED illuminate on the ignition module?
  - Y → Switch OK.
  - N → With manometer, take a reading from the inlet tube pressure tap. Is reading negative (-)1.2" W.C. or more? (see illustration below)
    - N → Is there continuity through the normally closed intake pressure switch? (see photo 34)
      - Y → See Exhaust Pressure switch (page 31) or Blower testing (page 27)
      - N → Remove hose from intake pressure switch and Restart heater. Does purge LED illuminate?
        - Y → See Exhaust Pressure switch (page 31) or Blower testing (page 27)
        - N → Isolate (disconnect) heater from intake vent system and Restart heater. Does purge LED illuminate?
          - N → See Exhaust Pressure switch (page 31) or Blower testing (page 27)
          - Y → Is intake vent system obstructed?
            - Y → Clear obstruction.
            - N → Call for technical support.
    - Y → Remove hose from intake pressure switch and Restart heater. Does purge LED illuminate?
      - Y → See Exhaust Pressure switch (page 31) or Blower testing (page 27)
      - N → Isolate (disconnect) heater from intake vent system and Restart heater. Does purge LED illuminate?
        - N → See Exhaust Pressure switch (page 31) or Blower testing (page 27)
        - Y → Is intake vent system obstructed?
          - Y → Clear obstruction.
          - N → Call for technical support.



Disconnect red wire leads from pressure switch and check continuity through switch.



Service Procedure EF-XI

Intake Pressure Switch Testing and Replacement

Used on EF water heaters prior to "CF" serial number.

Intake Pressure Switch Replacement Procedure

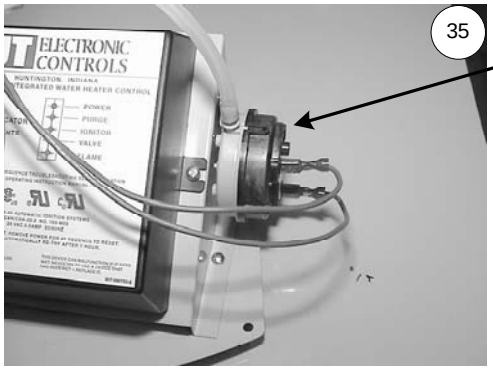
⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 1. Position main power switch to "OFF".

Step 2. Disconnect (Unplug) water heater from 120 Volt power source.

Step 3. Un-latch & remove surround cover from top of water heater.

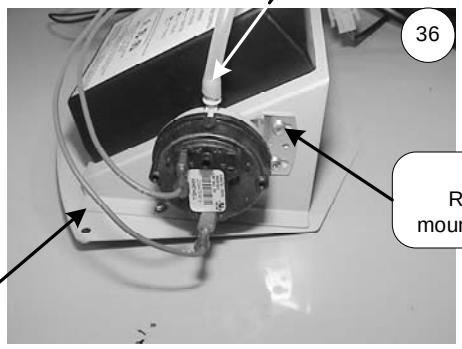
Step 4. Locate intake pressure switch on control panel inside surround area (see photo 35).



35

Intake pressure switch located on side of control panel

Step 6
Disconnect tubing from pressure switch



36

Step 7
Remove 2 mounting screws

Step 5
Disconnect red wires

Step 5. Disconnect red wire leads from pressure switch (see photo 36).

Step 6. Disconnect silicone tubing from pressure switch (see photo 36).

Step 7. Remove the two screws (Phillips screw driver) holding the intake pressure switch in place and remove pressure switch from control panel (see photo 36).

Step 8. Install new pressure switch and secure in place with screws from step 7.

Step 9. Reconnect silicone tubing (from step 6) to pressure switch.

Step 10. Reconnect red wires (from step 5) to pressure switch. Note: wires are interchangeable with either switch terminal.

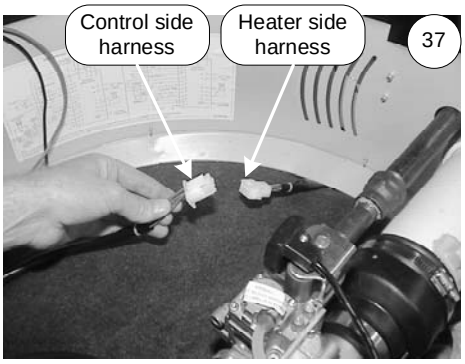
Step 11. Restore 120 volt power supply to heater & verify proper heater operation following the instructions on the lighting instruction label or the lighting instructions located in the installation & operation manual.

Step 12. Replace surround cover on top of heater.

Service Procedure EF-XII
Vent Safety Switch Testing and Replacement

Sequence of operation:
With the thermostat calling for heat, prior to energizing blower, the ignition module checks the vent safety switch for normal switch position of normally closed. If the vent safety switch contacts are open, (not in normal position), the ignition module waits indefinitely for contact to close, The vent safety switch must be manually reset to close the switch contacts.

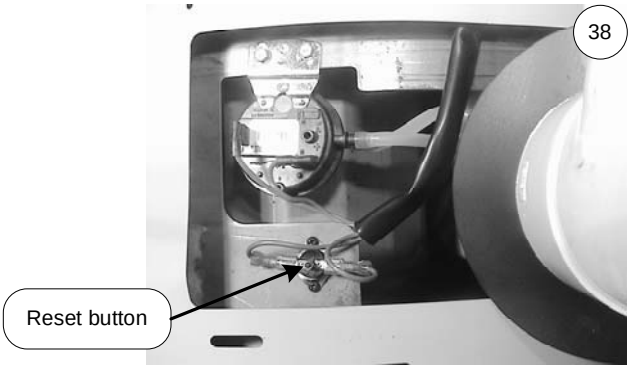
⚠ WARNING
120 volt potential exposure. Use caution making voltage checks to avoid personal injury.



Locate harness connection. (see photo 37)

Is there continuity Through GREY Lead wires of heater side harness? (see photo 37)
- Y → Reset heater, observe heating cycle. Does switch open?
- N → Depress reset button on high limit switch. Is there continuity across high limit switch? (see photo 38)
  - N → Replace vent safety switch (see pg 44)
  - Y → Does heater function?
    - N → Call technical support.
    - Y → Reset heater, observe heating cycle. Does switch open?

Reset heater, observe heating cycle. Does switch open?
- N → Is temp over 350°F?
  - N → DO NOT OPERATE HEATER System over heating, immediately contact technical support.
  - Y → System OK
- Y → Does switch open prior to 350°F?
  - N → DO NOT OPERATE HEATER System over heating, immediately contact technical support.
  - Y → Replace vent safety switch (see pg 44)

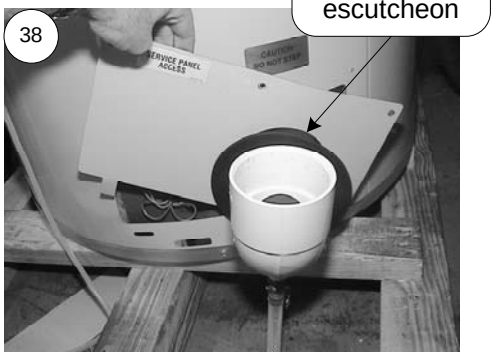


Vent Safety Switch Replacement Procedure

Step 1. Position main power switch to “OFF”.

Step 2. Loosen adhesive backed rubber escutcheon from service panel access cover and slide escutcheon back along exhaust pipe to allow for removal of cover (see photo 38).

Step 3. Remove screws from service panel access cover (¼" nut driver) and remove cover from heater (see photo 38)



Step 4. Disconnect wire leads from vent safety switch (see photo 39).

Step 5. Remove the 2 switch mounting screws (Phillips screw driver) and nuts (5/16 wrench) and remove switch from heater.

Step 6. Install new switch using screws from step 5.

Step 7. Reconnect wire leads.
Note: wire leads are interchangeable with either switch terminal.

Step 8. Restore 120 volt power supply to water heater and confirm proper operation following the lighting instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 9. Reinstall service panel access cover and rubber escutcheon.

Service Procedure EF-XIII
Anode/Flue Baffle Inspection and Replacement

Disassembly Procedure for Access to Anodes & Flue Baffles

⚠ WARNING
Heater components may be HOT when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

Step 1. Position main power switch to "OFF".

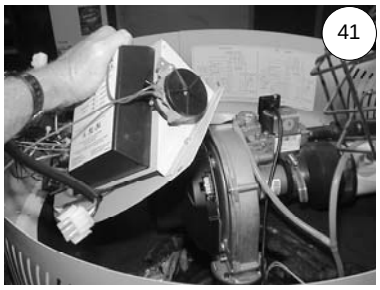
Step 2. Disconnect (Unplug) water heater from 120 Volt power source.

⚠ WARNING
120 volt potential exposure. Isolate the appliance and reconfirm power is disconnected using a multi-meter.

Step 3. Un-latch & remove surround cover from top of heater.

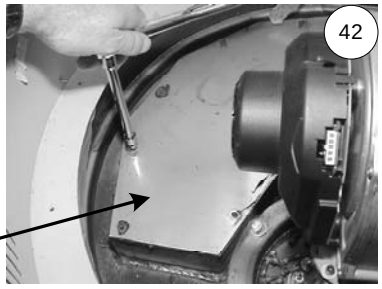
Step 4. Disconnect wire harnesses to allow for removal of control panel.
Note: Where ever possible, rather than disconnecting at the control panel, follow wire harness away from control panel and disconnect at control component location.

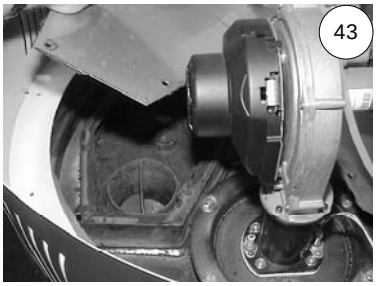
Step 5. Remove the three control panel mounting screws (¼" nut driver) and remove control panel from appliance (see photos 40 & 41).



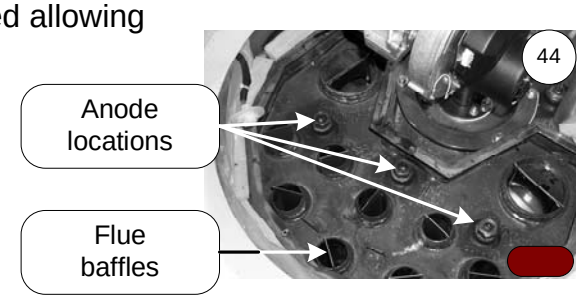
Step 6. Completely remove insulation (two pieces) from top of heater to expose collector cover

Step 7. Remove all collector cover screws (5/16" socket) and remove collector cover (see photos 42 & 43).





Step 8. Photo 44 shows heater with collector cover removed allowing access to anode rods and flue baffles.



a) for anode service, see page 46
b) for flue baffle service, see page 47
c) for powered anode service, see page 48

Note: EF100T399 models have only 1 anode rod under the 2nd pass collector cover.

Service Procedure EF-XIII

Anode/Flue Baffle Inspection and Replacement
(see page 47 for replacement)

Anode inspection and replacement

⚠ WARNING

Heater components and stored water may be HOT when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

Step 1. Turn off water supply and drain water heater.

Step 2. Disassemble heater per disassembly procedure on page 45.

Step 3. Locate and remove anode rods from heater (1-1/16 hex socket).

Step 4. Visually inspect anode rod. Anode rod should show signs of depletion, this is normal. If the depletion is ½ of the original diameter (approximately ¾" diameter), replacement is recommended. If any of the steel core of the anode is exposed, replacement is recommended.

Step 5. Upon completion of inspection or subsequent replacement, apply Teflon tape or other thread compound to threads of anode and reinstall into heater. Restore water supply and check for and repair any leaks found.

Step 6. Reinstall collector cover per procedure on page 49.

Step 7. Reinstall collector insulation and control panel, reconnect control panel wire harnesses.

Step 8. Restore 120 volts to water heater and verify proper heater operation following the instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 9. Replace surround cover on top of water heater.

Flue baffle inspection and replacement

⚠ WARNING
Heater components may be HOT when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

Step 1. Disassemble heater per disassembly procedure on page 45.

Step 2. Remove flue baffles from heater (pliers) (8 two inch baffles & 2 four inch baffles).

Step 3. Visually inspect flue baffles. Flue baffles should show signs of oxidation, this is normal. If the oxidation has deteriorated any portion of the flue baffle, replacement is recommended. If any restrictors are missing, replacement is recommended.

Step 4. Upon completion of inspection or subsequent replacement, reinstall flue baffles into heater.

Step 5. Reinstall collector cover per procedure on page 49.

Step 6. Reinstall collector insulation and control panel, reconnect control panel wire harnesses.

Step 7. Restore 120 volts to water heater and verify proper heater operation following the instructions on the lighting instruction label or the lighting instruction located in the installation and operating instruction manual.

Step 8. Replace surround cover on top of water heater.

Powered Anode Replacement EF100T399 models only

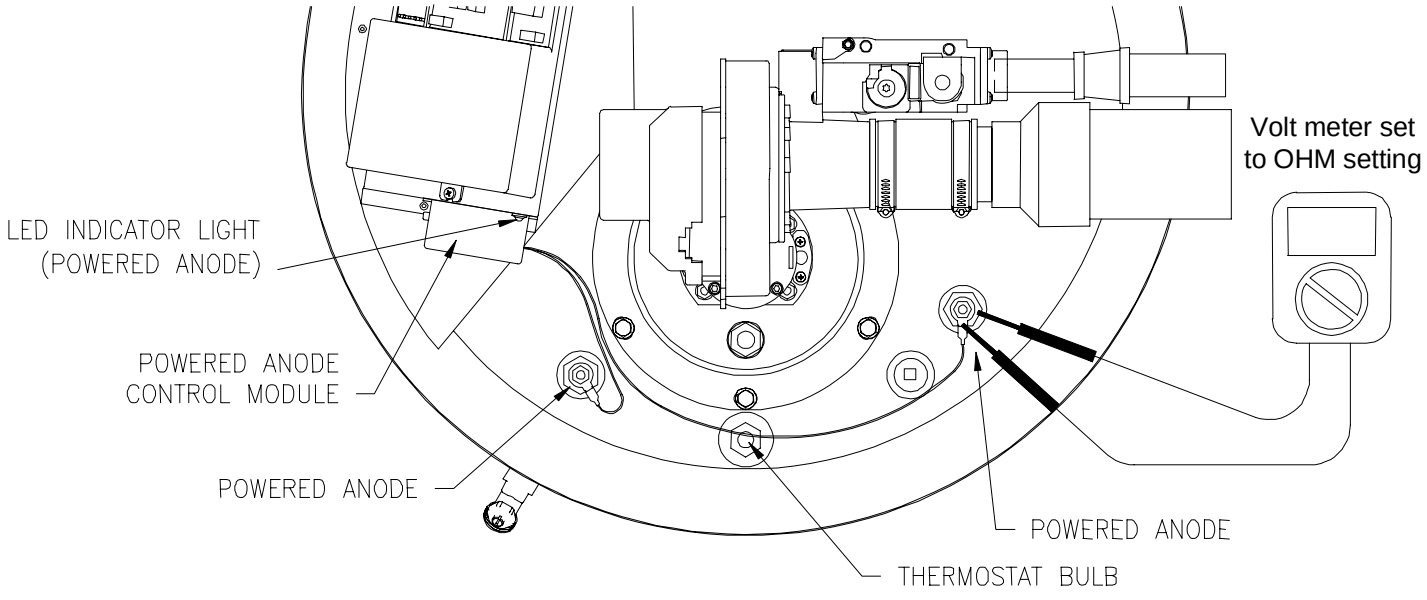
⚠ WARNING
Heater components may be HOT when performing the following steps in this procedure. Take necessary precaution to prevent personal injury.

The powered anode control module is located on the right vertical side of the control panel inside the surround panel. The control has a LED indicator light to show the status of operation. When the tank is filled with water and the power supply is on to the water heater, the light should have a steady green glow to indicate that protection current is flowing and operating normally. If the indicator light is not glowing, the power supply to the water heater or powered anode system is disconnected.

Step 1. Check the power supply or wire connections to the powered anode control.

Step 2. Indicator light diagnostic codes:
a) If the control is flashing red, then there is a malfunction with the powered anode system. Make sure there are no bare spots in the wire insulation to the powered anode rods.

Step 3. Check all electrical connections. The powered anode rods are insulated from the water heater tank in the bushing.
a) With an ohmeter, check continuity between the powered anode terminal and the bushing. There should not be continuity. If there is continuity, replace the powered anode assembly.



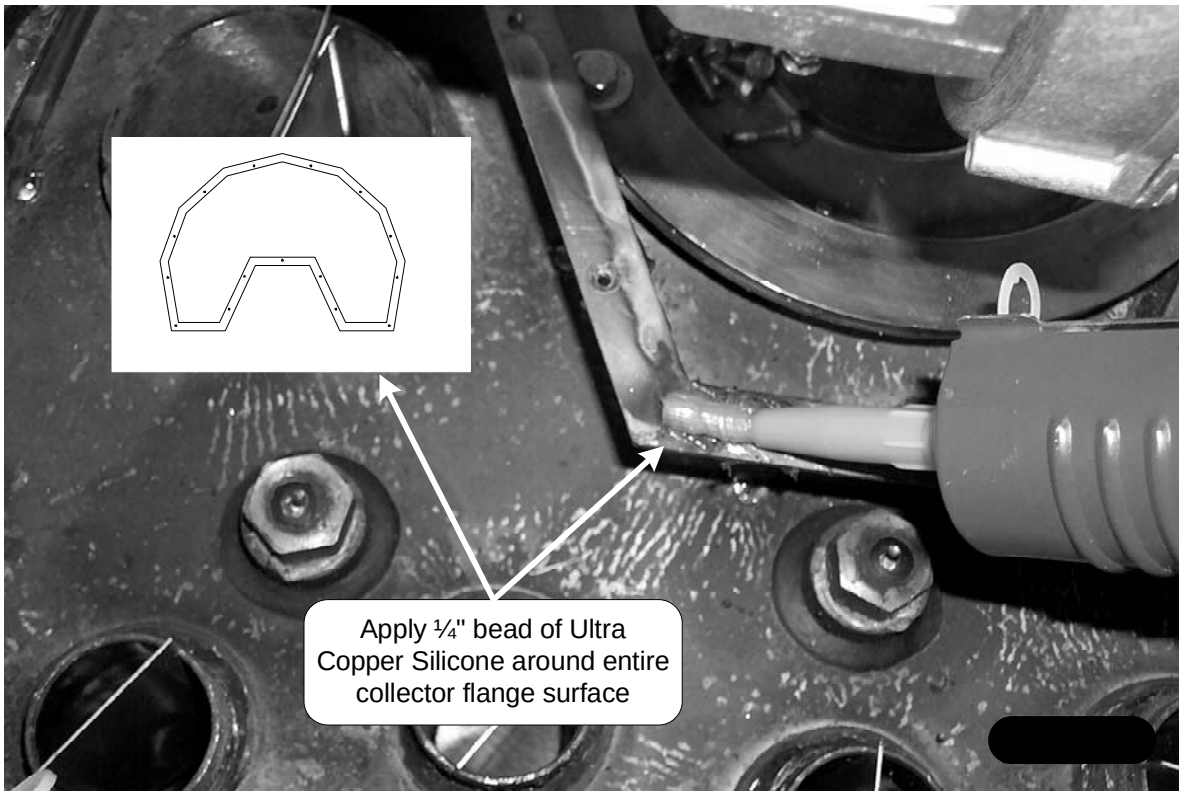
Collector Cover Installation Procedure

Step 1. Remove old silicone from top surface of collector flange and collector cover.

Step 2. Apply ¼" bead of Ultra Copper Silicone around entire collector flange surface. Allow caulk to “cure” for 10 minutes.

Step 3. Carefully reinstall collector cover, tighten screws evenly.

Step 4. Allow a minimum of 6 hours before putting heater back in service.



eF Series® Heater Installation Check List

Product Handling - Carefully uncrate the heater. Move in place with a hand truck (Do not use the venting pipes for handles).

Electrical Requirements - Make sure there is 120 volts line voltage. Line voltage must be properly polarized. Adequate ground supplied to the heater.

Venting Requirements - All venting must stay within the required lengths and diameter (see table below). Proper support of the venting pipe is a MUST (every 5ft vertical and 3ft horizontal). Termination must be located to prevent re-circulation of flue gases. Medium to long sweep 90° elbows or straight exhaust terminal coupling recommended.

Gas Requirements - Gas piping sized adequately, ¾" or larger to heater or 1" or larger for EF100T399 models. Install a properly sized regulator (if unknown, assure an adequate volume of gas is available). 7" W.C. is required when the unit is running. Gas pressure must stay below 14" W.C. static pressure. Pressure drops between static pressure and operating flow should be less than 3" W.C.

Condensate Requirements - Condensate line needs to slope to a drain at a minimum of ¼" per foot. Make sure the condensate line does not have the potential to freeze. If using more than one heater and using a common condensate line, make sure the condensate line is properly sized.

Service/Mechanical Room - Provide adequate space for servicing heater. Leave room to get to the top and bottom pressure switches as well as enough overhead room to remove the anode rods for servicing (18" min.).

Vent tables

Balanced Direct Vent Systems
PVC, CPVC or ABS

Total length of intake piping and exhaust piping added together must not exceed "Maximum Combined Length" Shown below

Maximum Combined Length (feet)

Model Number	3"	4"
EF60T125, EF100T150	120'	170'
EF60T150, EF100T199	100'	150'
EF60T199, EF100T250	80'	130'
EF100T300	60'	110'
EF100T399	50'	100'

Unbalanced Direct Vent Systems
Air intake CAN NOT exceed exhaust by more than 30 feet

Power Vented Systems
PVC, CPVC or ABS

Total length of exhaust piping must not exceed "Maximum Vent Length" Shown below

Maximum Vent Length (feet)

Model Number	3"	4"
EF60T125, EF100T150	120'	170'
EF60T150, EF100T199	100'	150'
EF60T199, EF100T250	80'	130'
EF100T300	60'	110'
EF100T399	50'	100'

Note: each 3" & 4" 90° Elbow is equivalent to 5 feet of straight pipe.
Note: each 3" & 4" 45° Elbow is equivalent to 2.5 feet of straight pipe.

eF Series® Heater Service Report

Date _____

Service Provider _____ **Model Number** _____

Phone Number _____ **Serial Number** _____

Venting (PVC, CPVC,ABS):

Vent size 3" or 4" _____

Intake 90's (qty) _____ Intake 45's (qty) _____ Length of straight pipe (intake) _____

Exhaust 90's (qty) _____ Exhaust 45's (qty) _____ Length of straight pipe (exhaust) _____

Gas Line:

Size & material _____

Distance from meter to water heater _____

Gas Pressure:

Static _____

Running Inlet _____

Manifold _____

Venturi:

Setting from Bottom in Turns _____

Electrical:

Line Voltage _____ Low Voltage _____ Polarity _____

Igniter Resistance: _____ Flame Sense Micro -Amps: _____

LED Flashing Y or N Which One(s) _____

Condensate Line:

Size & Material _____

Length _____

Is trap provided Y or N

Exhaust Collector Pressure:

Positive Inches W.C. _____

Combustion:

CO2 _____ CO _____

Installation Site Name & Address:

_____

_____

_____

_____

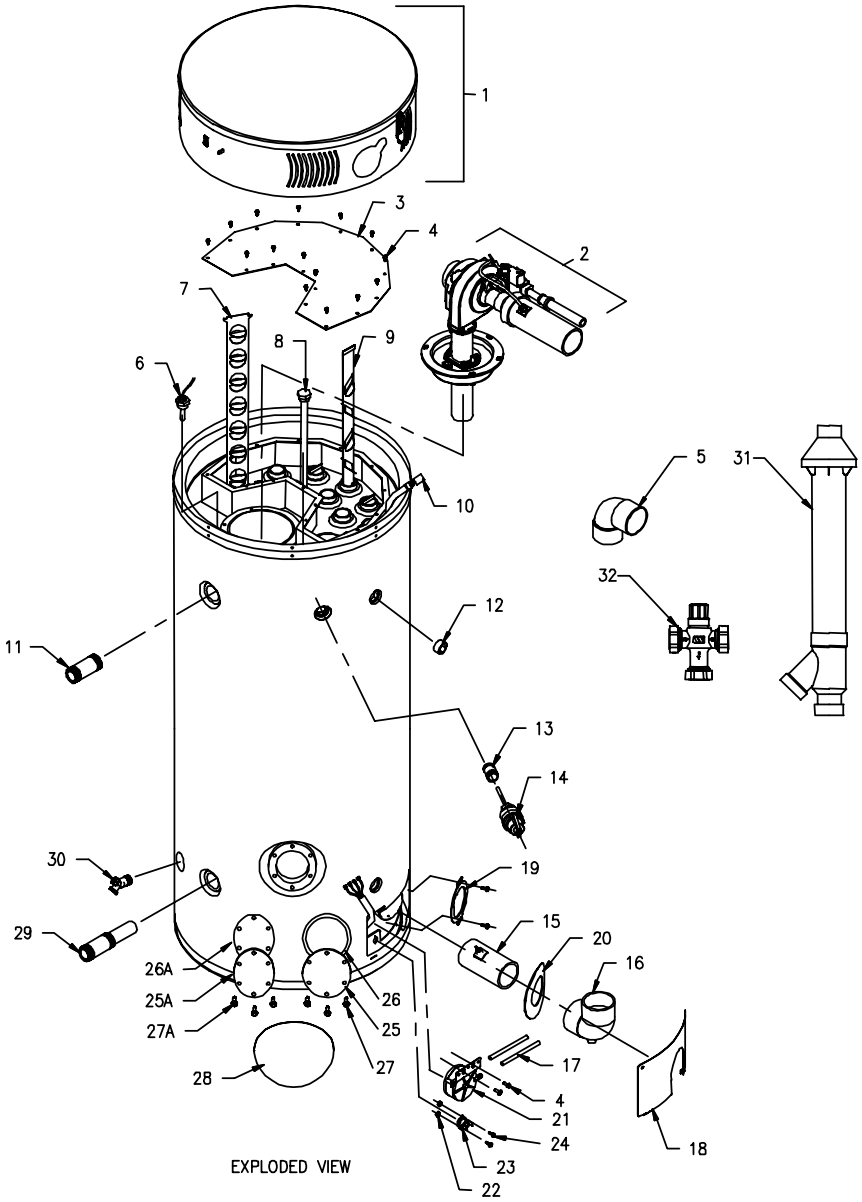
Installation Site Contact Name & Phone Number

_____

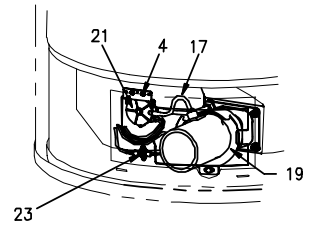
_____

_____

Parts List
Models prior to “CF” serial number



EXPLODED VIEW



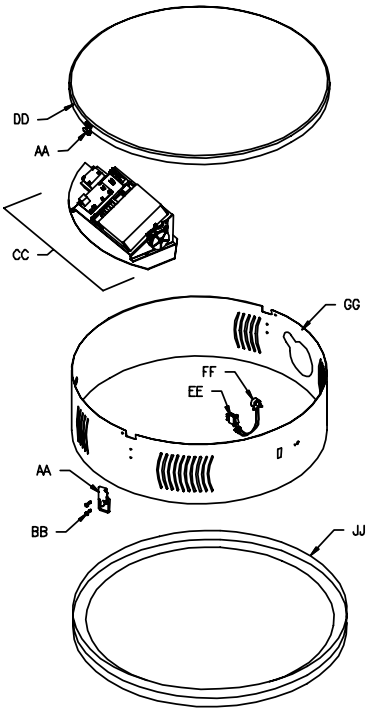
EXHAUST SERVICE AREA DETAIL
(ASSEMBLED)

1	Combustion surround assy.
2	Burner assy
3	2nd pass top collector cover
4	Screw 10-16 x 3/4
5	Vent termination elbow
6	Thermostat sensor probe
7	Baffle 4" flue
8	Mag rod
9	Baffle 2" flue
10	Wire harness service panel
11	Plastisert nipple 1-½" NPT
12	Plug
13	Nipple
14	T&P relief valve
15	Exhaust pipe (PVC) w/Hose barb
16	Condensate trap elbow
17	Silicone hose
18	Outer door service panel
19	Vent pipe support bracket
20	NSF Escutcheon
21	Exhaust pressure switch
22	Nut
23	Vent safety switch
24	Screw 6-32x 3/8
25	Cleanout access cover
26	Cleanout gasket
27	Screw 5/16-18 x ¾ HH grade 5
28	Cleanout cover
29	Cold water inlet
30	No handle brass drain valve
31	Coaxial vent system
32	ASSE approved mixing valve

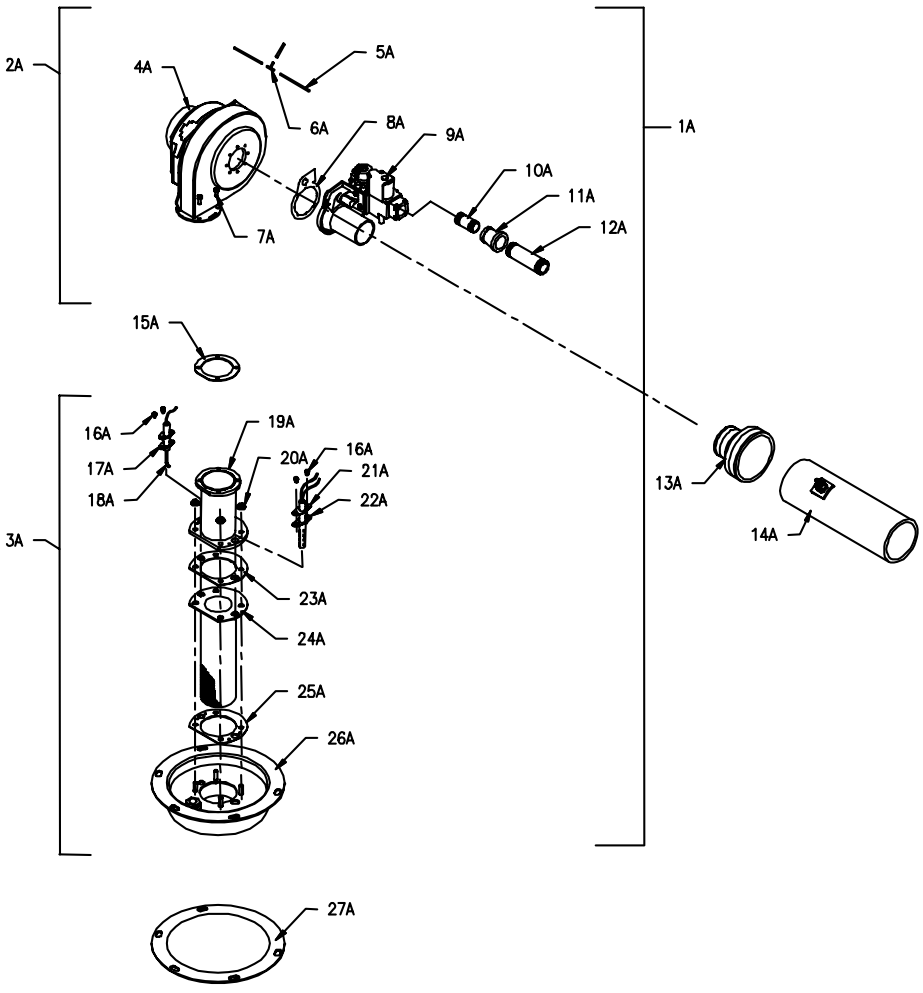
Customer must specify complete model number and serial number when ordering service parts.

Parts List
Models prior to "CF" serial number

AA	Latch assy
BB	Screw 8-32 x ½ RHCR
CC	Ignition control assy
DD	Jacket Head
EE	Main power switch
FF	Potentiometer
GG	Combustion surround
JJ	Surround base

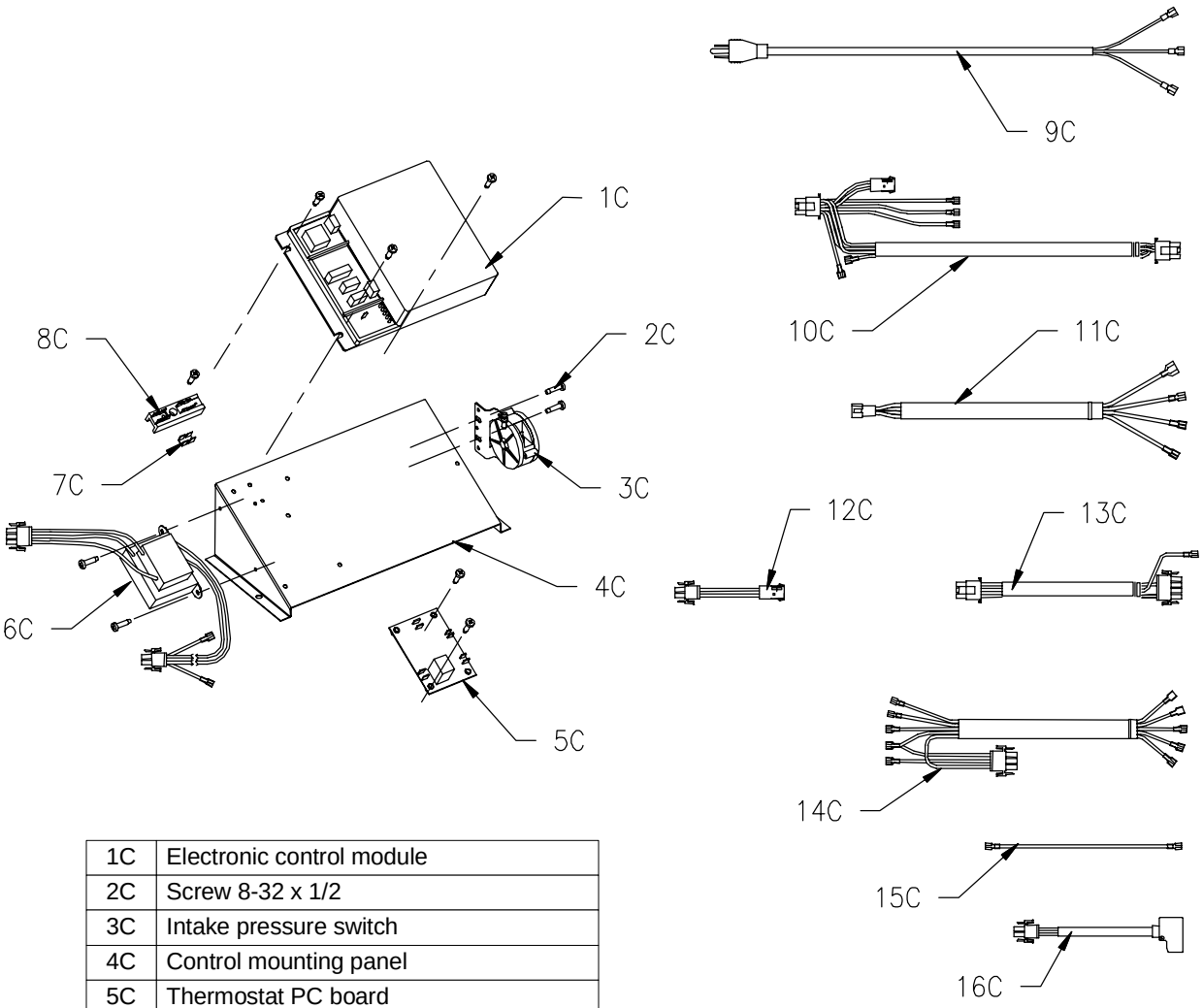


Customer must specify complete model number and serial number when ordering service parts.



1A	Combustion surround assy.
2A	Blower gas valve assy
3A	Burner assy
4A	Blower EBM
5A	Silicone hose
6A	Hose tee fitting
7A	Screw 10-32 x3/4
8A	Gasket & screw
9A	Gas valve
10A	Nipple ½" NPT X3"
11A	Reducer ¾ x ½ NPT
12A	Nipple ¾ NPT x 6"
13A	2" dia. Flex reducer
14A	Inlet (PVC)
15A	Gasket blower transition
16A	Screw 8-32 x ¼ RHCR
17A	Gasket flame sensor
18A	Flame sensor
19A	Transition tube
20A	Nut hex washer
21A	Gasket hot surface igniter
22A	Hot surface igniter
23A	Burner mounting gasket
24A	Burner tube
25A	Burner mounting gasket
26A	Burner mounting insert
27A	Burner mounting insert gasket

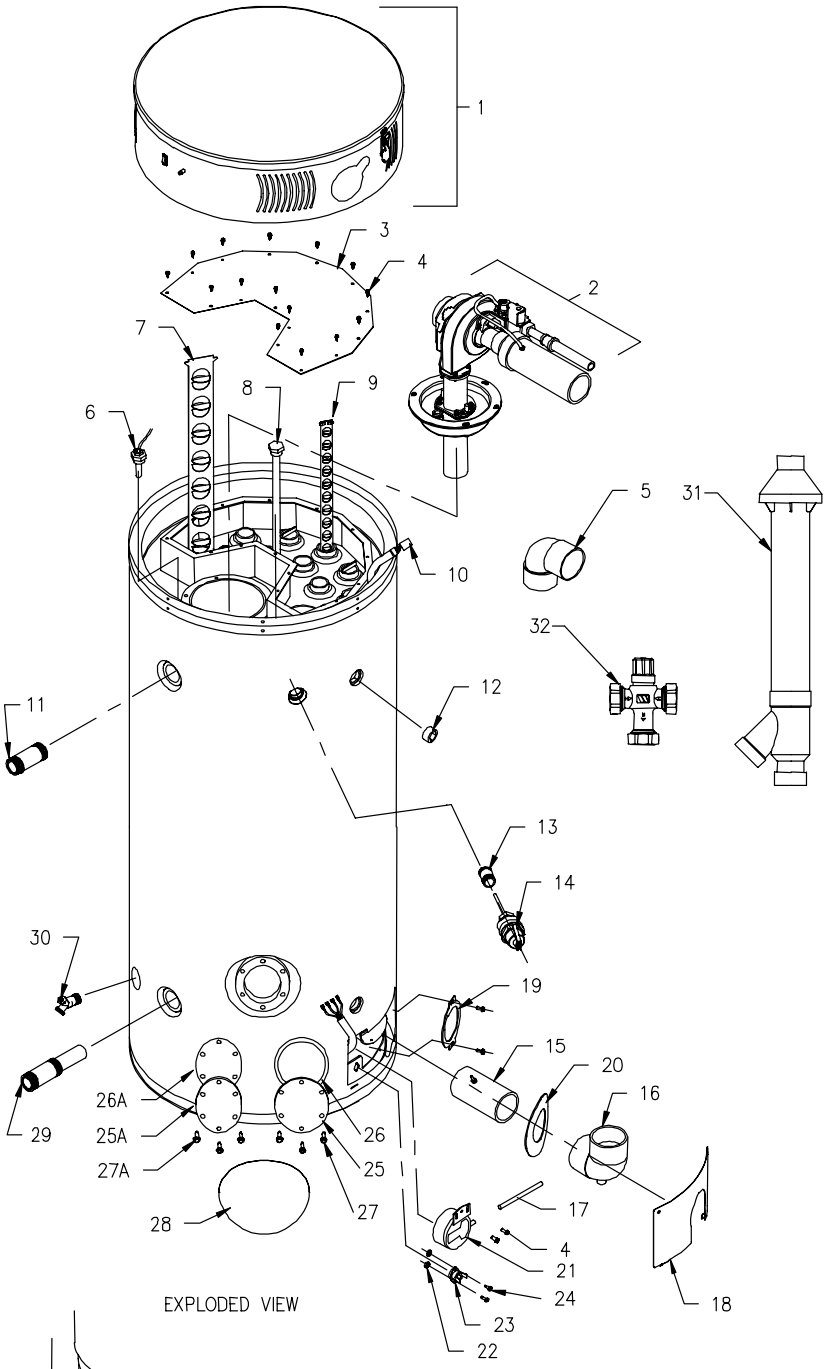
Parts List
Models prior to "CF" serial number



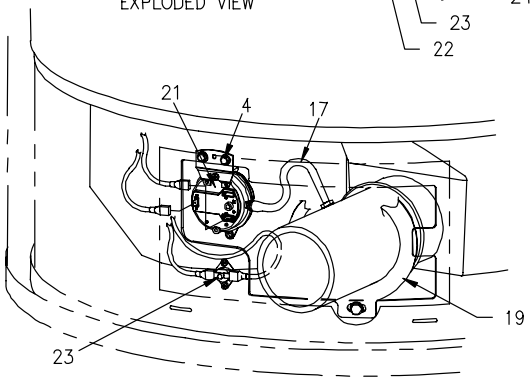
1C	Electronic control module
2C	Screw 8-32 x 1/2
3C	Intake pressure switch
4C	Control mounting panel
5C	Thermostat PC board
6C	Transformer 120VAC x 24VAC x 40VA
7C	Terminal
8C	Terminal strip
9C	Power cord
10C	Control wire harness
11C	Thermostat wire harness
12C	Igniter extension wire
13C	Blower wire harness
14C	Power switch wire harness
15C	Flame sensor wire harness
16C	Rectifier harness

Customer must specify complete model number and serial number when ordering service parts.

Parts List
For models with “CF” serial or later.



EXPLODED VIEW



EXHAUST SERVICE AREA DETAIL
(ASSEMBLED)

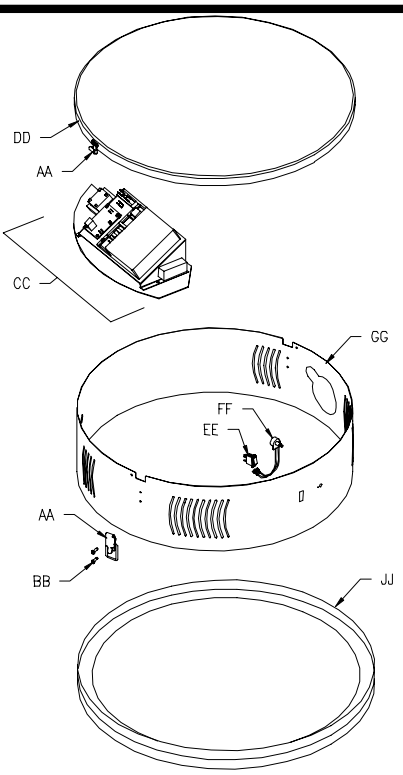
1	Combustion surround assy.
2	Burner assy (specify model)
3	2nd pass top collector cover
4	Screw 10-16 x 3/4
5	Vent termination elbow
6	Thermostat sensor probe
7	Baffle 4" flue (specify model)
8a	Anode rod assy
8b	Powered anode (for EF100T399)
9	Baffle 2" flue
10	Wire harness service panel
11	Plastisert nipple 1-½" NPT
12	Plug
13	Nipple
14	T&P relief valve
15	Exhaust pipe (PVC) w/Hose barb (except EF100T399)
16	Condensate trap elbow (specify model)
17	Silicone hose
18	Outer door service panel (specify model)
19	Vent pipe support bracket (except EF100T399)
20	NSF Escutcheon
21	Exhaust pressure switch
22	Nuts
23	Collector temperature limit switch
24	Screw 6-32x 3/8
25	Cleanout access cover
26	Cleanout gasket
27	Screw 5/16-18 x ¾ HH grade 5
28	Cleanout cover
29	Cold water inlet (hydrojet) ass’y.
30	No handle brass drain valve
31	Concentric vent system (optional)
32	ASSE approved mixing valve (optional)

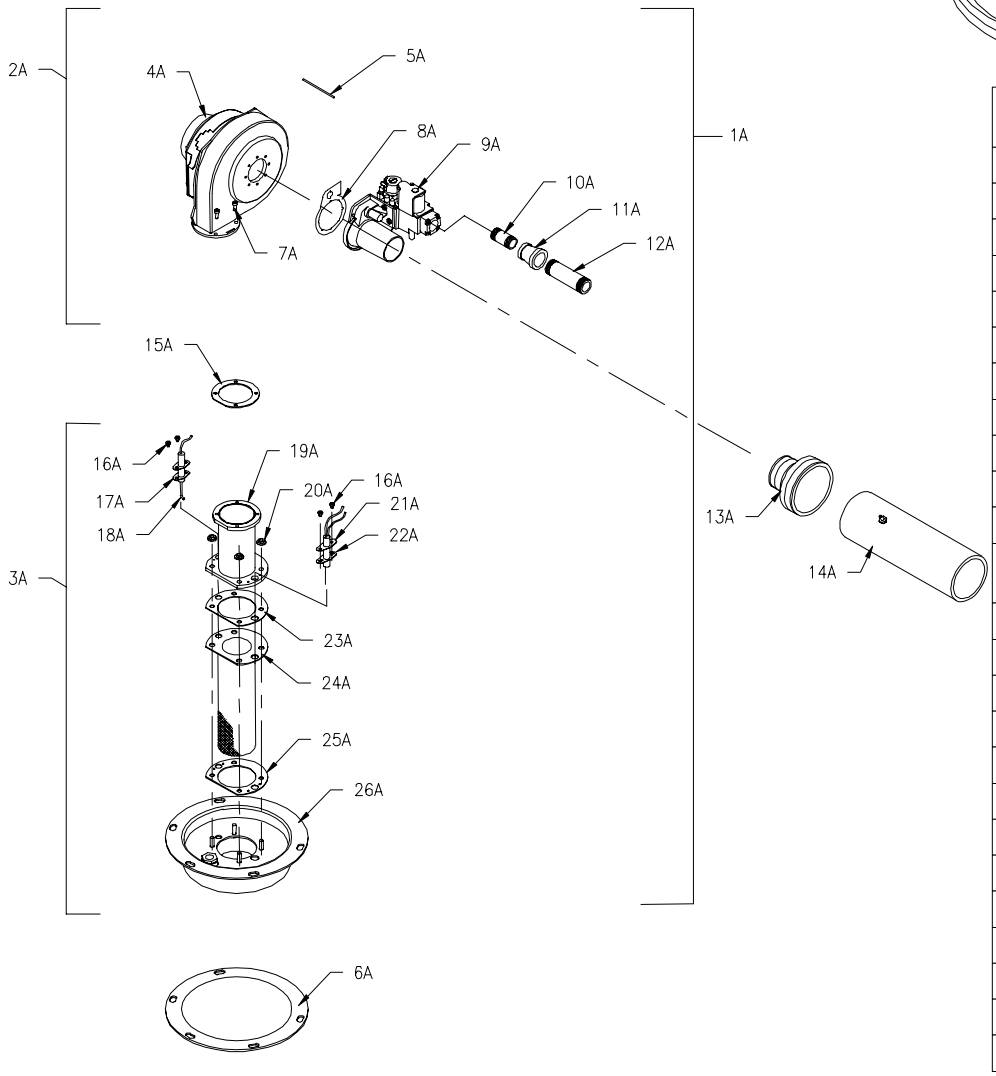
Customer must specify complete model number and serial number when ordering service parts.

Parts List
For models with “CF” serial or later.

AA	Latch assy
BB	Screw 8-32 x ½ RHCR
CC	Ignition control assy
DD	Jacket Head
EE	Main power switch
FF	Potentiometer
GG	Combustion surround
JJ	Surround base

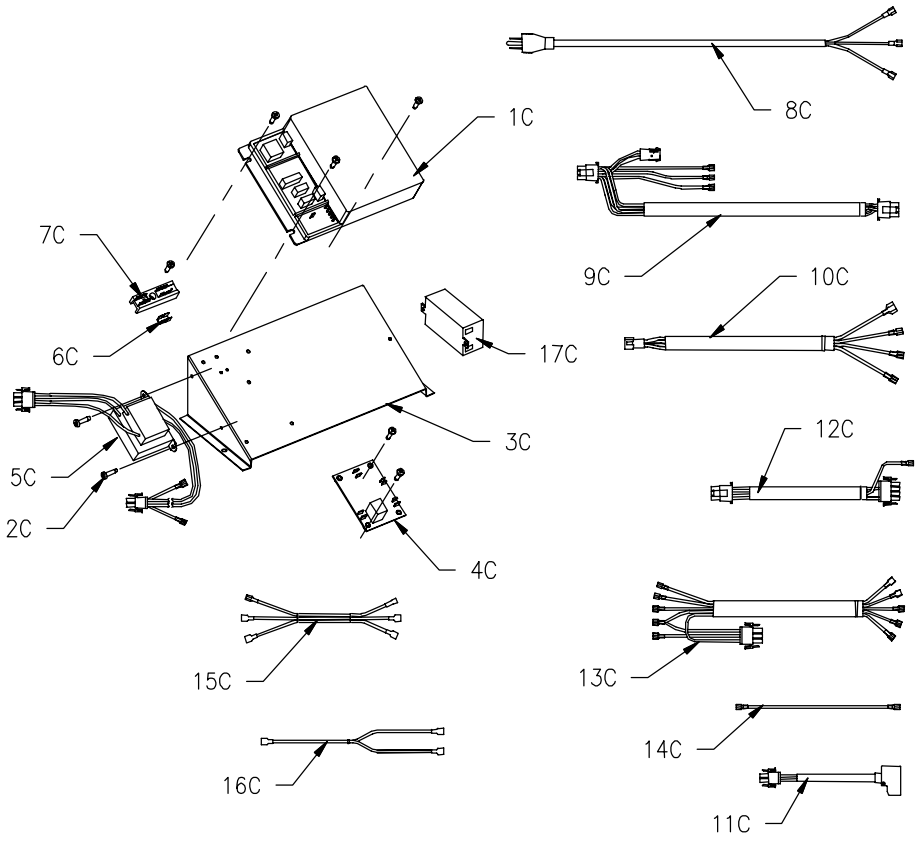
Customer must specify complete model number and serial number when ordering service parts.





1A	Combustion surround assy. (specify model)
2A	Blower gas valve assy (specify model)
3A	Burner assy (specify model)
4A	Blower EBM (specify model)
5A	Silicone hose
6A	Burner mounting insert gasket
7A	Screw 10-32 x3/4
8A	Gasket & screw
9A	Gas valve (specify model)
10A	Nipple (specify model)
11A	Reducer (specify model)
12A	Nipple (specify model)
13A	2" dia. Flex reducer (or PVC reducer for 399)
14A	Inlet (PVC)
15A	Gasket blower transition (specify model)
16A	Screw 8-32 x ¼ RHCR
17A	Gasket flame sensor
18A	Flame sensor
19A	Transition tube
20A	Nut hex washer
21A	Gasket hot surface igniter
22A	Hot surface igniter
23A	Burner mounting gasket
24A	Burner tube
25A	Burner mounting gasket
26A	Burner mounting insert

Parts List
For models with “CF” serial or later.



1C	Electronic control module
2C	Screw 8-32 x 1/2
3C	Control mounting panel
4C	Thermostat PC board
5C	Transformer 120VAC x 24VAC x 40VA
6C	Terminal
7C	Terminal strip
8C	Power cord
9C	Control wire harness
10C	Thermostat wire harness
11C	Rectifier harness (specify model)
12C	Blower wire harness (specify model)
13C	Power switch wire harness
14C	Flame sensor wire harness
15C	Powered Anode Control Harness (399 only)
16C	Powered Anode Harness (399 only)
17C	Powered Anode Control (399 only)

Customer must specify complete model number and serial number when ordering service parts.

Glossary of Terms

AC	Alternating Current
BTU/H	British Thermal Units
CO	Carbon Monoxide
CO2	Carbon Dioxide
DC	Direct Current
ECO	Energy Cut Off
GFI	Ground fault interrupt
GPM	Gallons per Minute
HSI	Hot Surface Igniter
Hz	Hertz
LED	Light Emitting Diode
NOx	Oxides of Nitrogen
NPT	National Pipe Thread
PSI	Pounds per Square Inch
RPM	Revolutions per Minute
VA	Volt Amps
VAC	Volts Alternating Current
W.C.	Inches of Water Column
°C	Degrees Centigrade
°F	Degrees Fahrenheit
µA	Micro Amp

NOTES

NOTES

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Ambler, PA

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